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WHO'S WHO

MR. KINGMAN BREWSTER

MR. KINGMAN BREWSTER is one of the large group of men of legal training who have in recent years been appointed to important executive positions. The value of that training in the analysis of trade and market conditions and the systematic construction of a sales campaign is obvious. The work which Mr. Brewster did as vice-president and general sales manager of the Greenfield Tap & Die Corporation attracted the attention of the directors of the Millers Falls Co., who have just made him president.

Mr. Brewster was born in the little hill town of Worthington, Mass., Dec. 24, 1882, and went through the village schools, going on to Williston Seminary at Northampton. From there he entered Amherst College in the fall of 1902. The fondness for outdoor life which has helped him to develop a first-class game of golf in his later years was a striking characteristic of his college experiences. He played football and baseball, and was captain of the college basketball team in one of its most successful seasons.

For two years following his graduation he was engaged in special research and sociological work in New York, and in the fall of 1908 he entered the Harvard Law School, from which he was graduated in 1911. Two years of successful practice on the Pacific Coast were followed by other years in Springfield, where his professional activities led him more and more into the organization problems of business. He was Registrar and Counsel of the Federal Land Bank upon its establishment in Springfield, Mass.

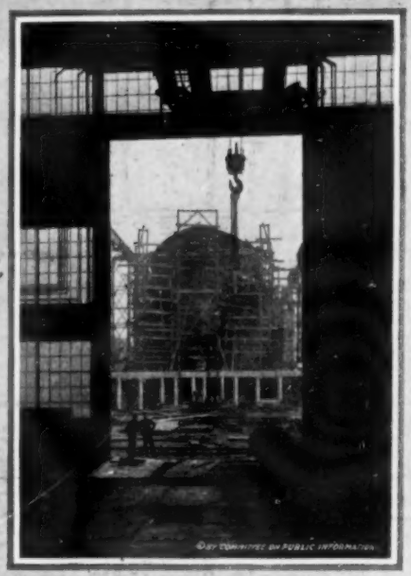
Mr. Brewster was for two years vice-president and general sales manager of the Greenfield Tap & Die Corporation, and brings to his new responsibilities a thorough training in the fundamentals of organization, distribution and sales.

January 1, 1920 American Machinist Vol. 52, No. 1

Pre-assembly in Ship Construction

By R. D. Gatewood,
COMMANDER U. S. N.

U. S. NAVY YARD,
PHILADELPHIA,
PENN.



The application of pre-assembly methods to ship building is accomplishing just what it does in other branches of machine work. It makes possible the building of parts where there is plenty of room to work and prevents the delay of one gang waiting for another to get through. This method should be carefully considered by all ship builders and those engaged in many other lines, for with labor shortage an unpleasant actuality, lost time is a serious matter and one to be avoided.

SUPPOSE you had just received a contract for 40 airships or automobiles, 40 pumps or penstocks, 40 lathes or locomotives, or even for forty 8800-ton merchant ships—each one exactly alike—wouldn't it occur to you right away, as a good business proposition, to build each integral part or piece in lots of 40?

Now, while you are supposing pleasant conditions to make the work easier, just go a step farther and suppose the contract called for delivery "at the earliest possible date" or thereabouts, because the ships were very valuable *now* but wouldn't be perhaps in the distant future. And suppose you had only twelve building slips to launch these ships from and were anxious to get each ship overboard so that you could lay down the ones that were to follow as soon as possible or perhaps sooner. Wouldn't it seem logical to build each part wherever you could find suitable space for it in your big yard and assemble the parts later in some one place, rather than to try to crowd and jam the building of all the separate parts into the confined area of a building slip?

Suppose you had an unusually large yard area, unusually well served with cranes and transportation facilities, and you couldn't get all the skilled labor you needed and, moreover, the cost of the ships, as is the case *even* with ships built for the Government, was to be "reduced to a minimum," wouldn't you try to train

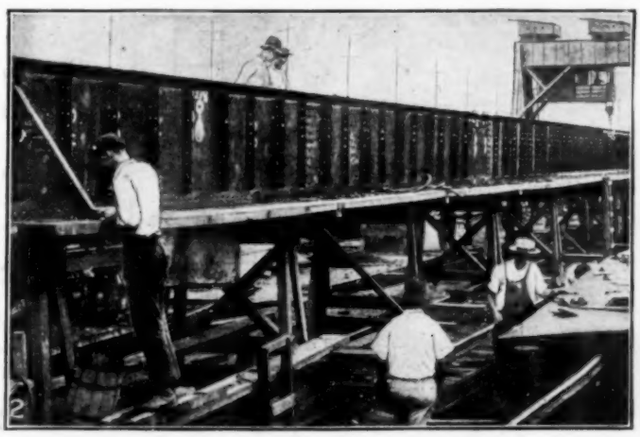


FIG. 2. ASSEMBLING THE KEEL

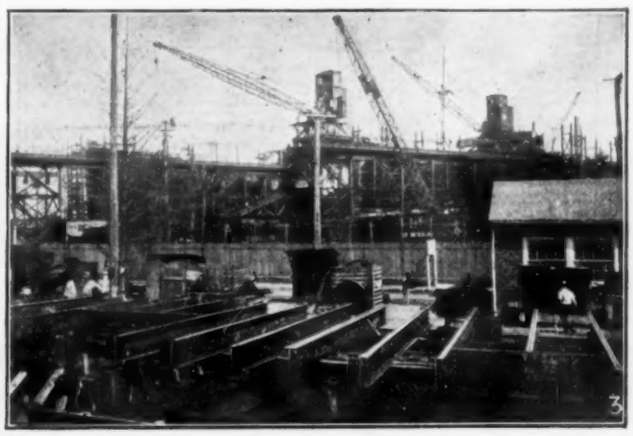


FIG. 3. BULKHEAD ASSEMBLY

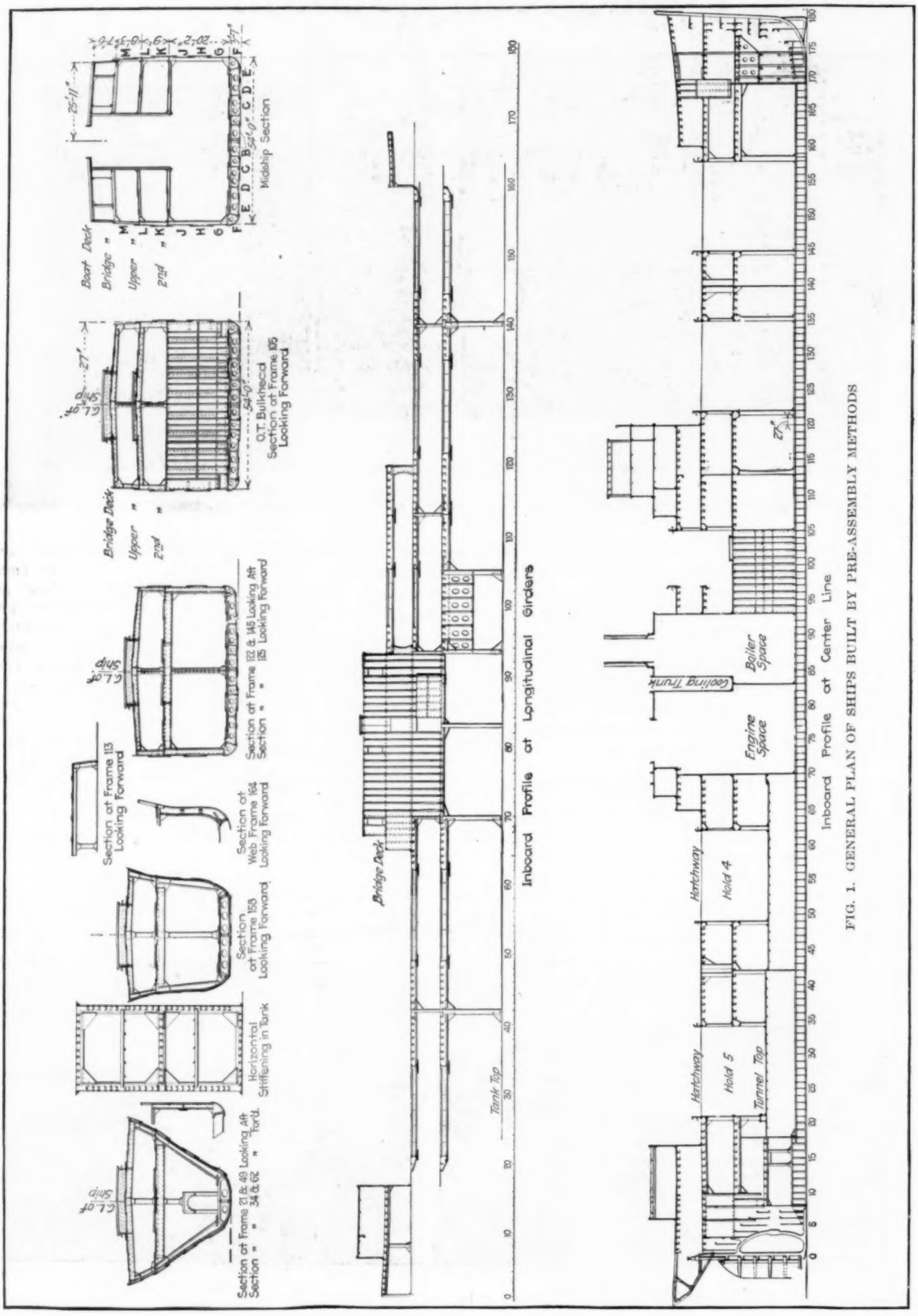


FIG. 1. GENERAL PLAN OF SHIPS BUILT BY PRE-ASSEMBLY METHODS

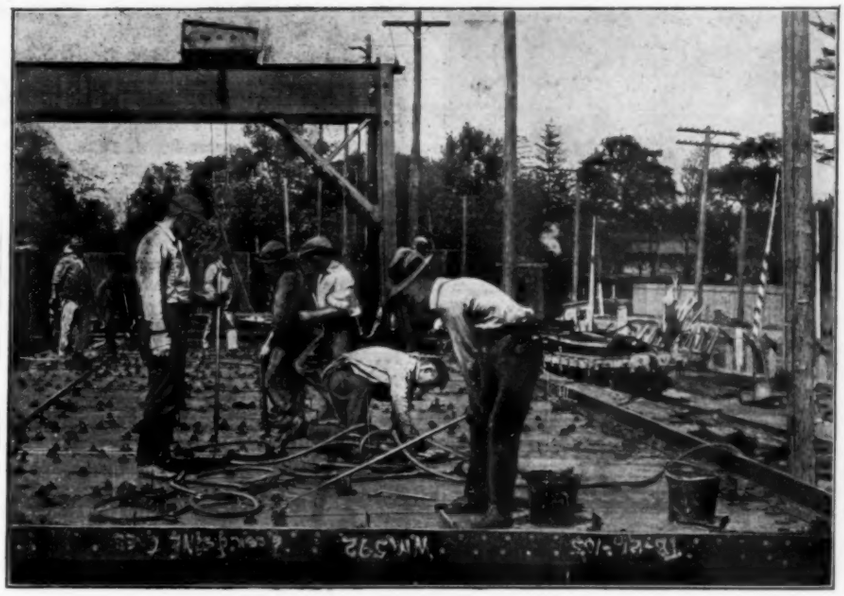


FIG. 4. AN OIL-TIGHT BULKHEAD

the *same* set or "gang" of unskilled men to build the *same* part so far as possible, leaving the more difficult regulating, fairing, and final connecting to the more skilled men?

And if the price for assembling and riveting was much less when done in the yard, or "on the ground" as it is called, than when done on board ship where many places are dark and inaccessible and hard to work in and harder to supervise in, wouldn't it seem reasonable to do all you could out in the yard where it is light and there is plenty of room to work? Besides getting more work, wouldn't you think the quality of what you got would be better when done out in the light where the men could see what they were doing and you could see what they were doing too?

This pre-assembly proposition, involving as it does a division of labor and a distribution of effort, seems a very simple, common-sense solution of a large construction project where the saving of time and money is a governing feature, and one asks involuntarily why no one thought of it before and, now that it is thought of and practiced, why everyone in the shipbuilding world doesn't accept it at once as the best and most advanced practice?

Whoever thought of building forty 8800-ton ships at the same plant in two years; whoever thought of a shipyard with fifty building-slips; whoever thought of building ships "custom-made" instead of "made to order" anyway? Nobody but "a damned Yankee." That's the principal reason why everyone doesn't accept it right away, because you've got to be big enough to think in big figures and lots of us aren't that big. Then, too, there has always been a more or less accepted way to build a ship just as there has been to make a dress. If somebody told a woman that a way had been devised for making her dress by making the skirt, the waist, the sleeves, the neck, and ruffles, all separately and bringing them together and finding that they fitted each other and that the dress fitted her the very first time—would she believe it? She would *not*.

Yet that is just what the Merchant Shipbuilding Corporation is doing for the Emergency Fleet Corporation at their plant at Harriman on the Delaware River. It was just such ideas as this, just such "dreams" as people called them at first, that the Government in its great wisdom allowed to percolate into Germany soon after they were born.

This particular shipyard was not the first to adopt pre-assembly. Nor would it advise it for other yards not similarly laid out and equipped. But it is the first in this country or abroad to develop it to its present radical extent so that each of the hundreds of integral parts of its ships is built complete in itself and afterward assembled very much as is the case with watch or rifle construction. The principal considerations that governed this shipyard in making this radical departure from conventional shipbuilding were:

First—Forty identical ships to build.

Second—Ample space in the assembly yard (very seldom found in any shipyard).

Third—Ample crane service in assembly yard, permitting the easy handling of material which can be delivered at approximately the point of assembly.

Fourth—The layout of the plant enabled the assembling of large units in spaces outside the assembly yard (spaces almost never available in the average yard).

Fifth—Capacity of yard cranes permitting the handling of weights up to 50 tons.

Sixth—Inability to get skilled labor needed to assemble and install on board, but ability to get unskilled labor that could specialize on multiple work on the ground.

Seventh—Tidal conditions prevailing making it impossible to work on the sterns of vessels on the slips longer than three or four hours a day.

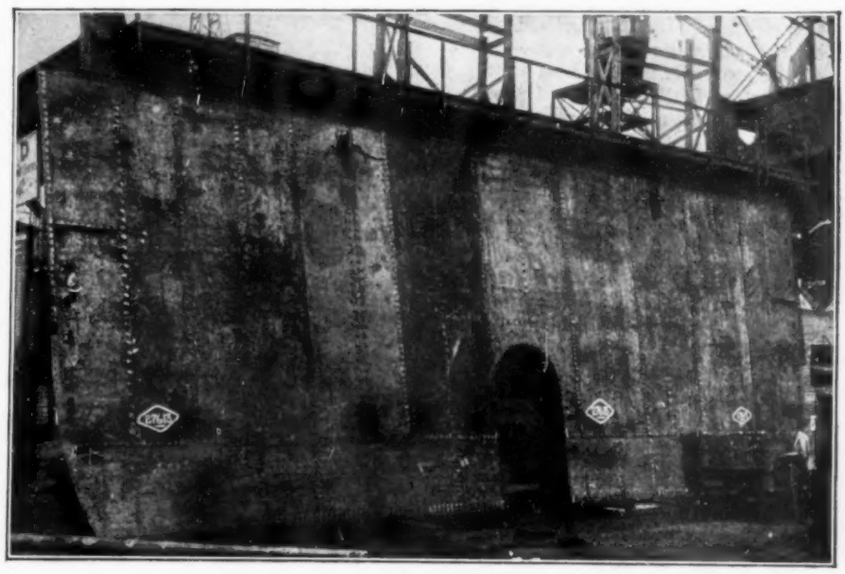


FIG. 5. A COMPLETE TRANSVERSE BULKHEAD

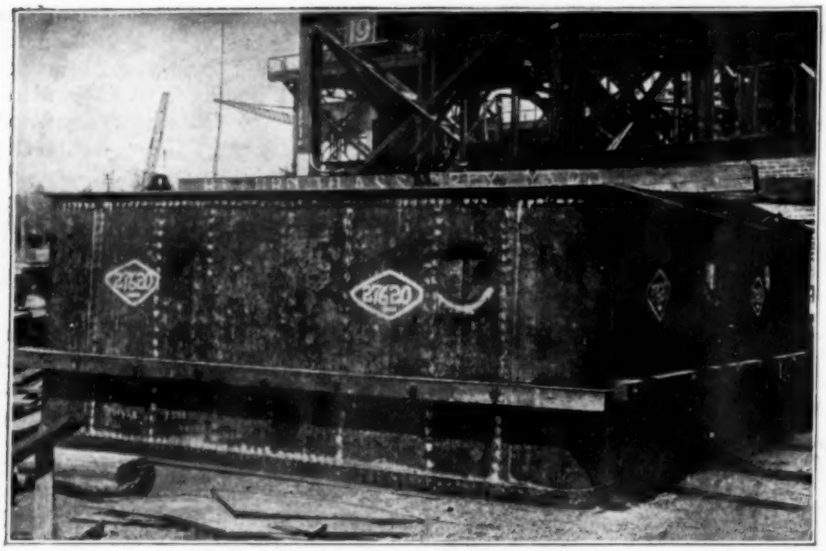


FIG. 6. NAVIGATING-BRIDGE DECK HOUSE

The general practice of this shipyard gained after much hard experience and now well standardized is so different from the more or less established way of constructing large vessels and is believed to be of such interest and real value to the progressive and practical shipbuilders and ship mechanics of the country that it is given in what follows in considerable detail.

The type plan of vessels under construction is shown in Fig. 1 and it should be remembered that the frame spacing is only 27 in. and that frames are numbered from the stern forward.

The details follow:

THE KEEL.—This section extends from frame No. 19½ to No. 169. The assembly includes all flat keel plates, vertical keel slip connections to floors, top and bottom keel angles. This section is assembled complete on the ground on a set of skids prepared for this purpose. The work is bolted, reamed and the keel checked for fairness and length. The only riveting performed is through the keel plate to bars. The reason for driving these rivets is to obtain a fair surface when laying keels on the permanent blocks at shipways, and to prevent, as far as possible, the removal of keel blocks. This section is approximately 350 ft. long. For erection it is divided into four sections which necessitate three splices. No additional expense is involved in the riveting. By this method a keel can be laid complete in 30 min.—the laying of the entire length of keel taking place 6 hr. after the launching of a boat. Immediately after keel laying and bolting up of splices, two gangs of riveters are started at center. One gang works aft and the other forward in order to keep clear of the erectors who start in the midship portion of the ship.

The top and bottom bars on the first nine boats were riveted except the splices. It was found that an accumulation of odd rivets was the result of this method; therefore the riveting of this work was discontinued on the ground and is now being performed on the ship as mentioned.

AFTER SECTION OF VERTICAL KEEL, FRAMES NO. 8 TO NO. 18.—This section includes after keel plates, rider plates, top and bottom, and fore and aft angles, floors No. 9 to No. 18 and B-2 shell plates, port and starboard. This work is assembled complete and riveted, including the B-2 shell plates. The rider plates are assembled and the work is driven in a downward position, Fig. 2. Then the section is inverted and the bottom shell plates fitted and riveted in a downward position. This permits the work to be performed in the easiest manner. There are a number of reasons that make it possible to save a greater amount of time and cost on this unit than on the ordinary assembly unit:

First—The work on the rider plates when assembled and riveted on the ship is performed in a very cramped and difficult position; the work on the B-2 shell plates is also very difficult and inaccessible and is performed under the worst conditions of overhead work. This is made very easy in an inverted position.

Second—The tidal conditions at this yard are such that no work can be performed in this locality except at low tide. Under the best working conditions and the best tidal conditions, four hours a day is the greatest amount of time in which work can be carried along.

FLOORS, NO. 19 TO NO. 47 INCLUSIVE; NO. 152 TO NO. 168 INCLUSIVE.—These floors are sent to this yard with the top and outboard angles already riveted. This yard furnaces and fabricates the bottom angle or channel, whichever the case may be. These channels are then bolted and bull riveted in the assembly yard. When erected, these floors are practically in the same condition, as to completion, as the floors in the amidship section which are sent from the American Bridge Company.

MAIN BULKHEADS, 42, 70, 83, 93, 105 AND 140, TANK TOP TO 2ND DECK, AND BETWEEN-DECK BULKHEAD, 2ND DECK TO UPPER DECK.—The bulkheads are assembled and riveted complete on the ground. All bounding angles, except the wing staples, are included in the assembly and riveted. The object in riveting these bulkheads complete is to establish a fairing-up point at the ships. At this yard no ribbands[1] of any description are used for fairing up. The bulkheads are checked for width and height, which assures a correct point to work to. When erected, these bulkheads are horned[2] and all other work made to come to these points. Up to hull No. 15 these bounding angles were left loose, but it was found that the fairing-up point which had been established was not correct unless these were riveted. See Figs. 3, 4 and 5.

[1] "Ribband"—A stiff timber used for fairing and holding in place the frames.

[2] "Horned"—Squared with the keel.

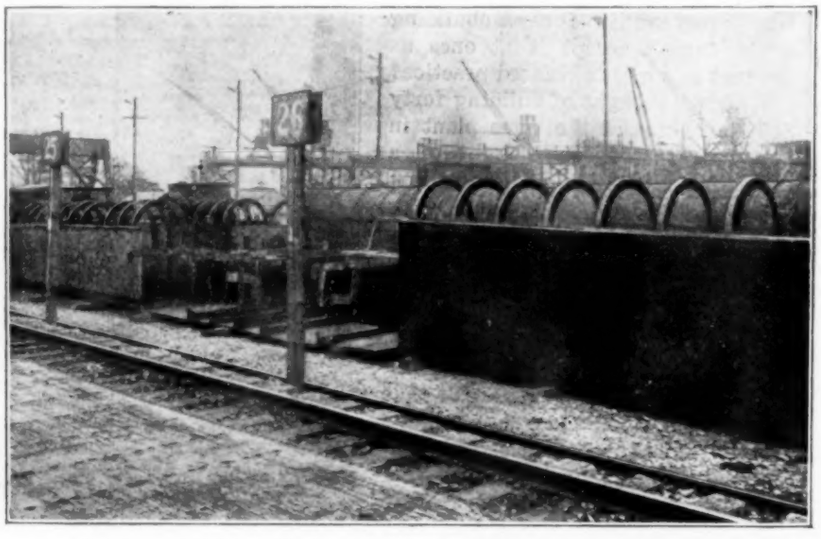


FIG. 7. ASSEMBLING THE SHAFT ALLEY

AFTERPEAK BULKHEADS NO. 8 AND NO. 10. FORECASTLE BULKHEAD NO. 169.—These bulkheads form the forward boundary of the afterpeak bulkhead and are very important from the standpoint of getting a high grade of work, which is only possible by assembling complete on the ground and riveting.

It should be particularly noted that bulkheads Nos. 8, 10 and 169 are very difficult, inaccessible work in a close corner of the ship, it being almost impossible to do good work in such spaces.

Bulkheads Nos. 8 and 169, which carry the heaviest pressure, are assembled complete and are bull riveted and calked before being erected. The amount of trouble, time and cost saved by the assembly of this section can only be appreciated by one who has attempted to perform this work in the close spaces which are common to the ends of all ships.

FORECASTLE-END BULKHEAD NO. 160.—The same remarks apply to the forecastle-end bulkheads as to the main bulkheads, except that the outboard angle connections to the shell are lifted from ship, this being a point where the ship must be fair and this particular part of the work must suit conditions.

BRIDGE-FRONT BULKHEAD NO. 120; BRIDGE-END BULKHEAD NO. 65; POOP-FRONT BULKHEAD NO. 17.—These bulkheads are assembled complete and riveted, with all bounding angles riveted. They establish the same fairing-up points as the main bulkheads.

On bulkhead No. 65 on the port side, two plates are left loose for shipping the fresh-water tanks, which are located under the bridge deck.

FORWARD-BRIDGE DECK HOUSE.—These houses are assembled complete with all connections, tie plates, beams, face bars, collars, etc., and are riveted complete on the ground except the bottom bounding angles which are left loose for adjusting and fairing up. On one hull, No. 16, trouble was experienced in regulating the bridge-front-bulkhead connection to the forward-bridge deck-house connection. This has been overcome by making a template from bulkhead No. 120 and regulating the forward-bridge deck house to this template.

The bottom bounding-angles were riveted up to and including hull No. 18. From this point, these angles are being left loose, trouble having been experienced in regulating this connection.

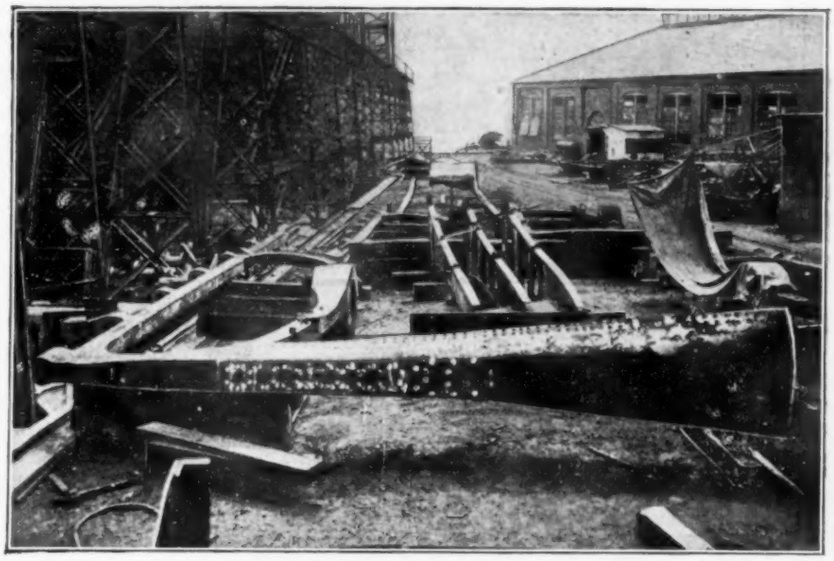


FIG. 9. STERN FRAMES LAID OUT

NAVIGATING-BRIDGE HOUSE.—The same remarks apply to this section as to the forward-bridge deck house, except with respect to the connection to bulkhead No. 120. See Fig. 6.

POOP-DECK HOUSE.—The same remarks apply as to the navigating-bridge deck house.

AFTER BOAT-DECK HOUSE.—This deck house is assembled in five pieces—owing to the fact that it is not continuous on account of the boiler and engine casing—one section port and one section starboard, one section aft and two sections forward. These sections are assembled complete in every respect with the exception of the bottom bounding angles. The same remarks apply to the bottom bounding angles as regard the forward-bridge deck house.

SHAFT ALLEY.—The shaft alley extends from bulkhead No. 18 to No. 70. This alley is assembled complete in two sections, and riveted, with stiffeners, floor plates, supports and shaft bearers.

Owing to the way material comes in, considerable difficulty has been experienced in assembling this unit, but gangs of specialists have been developed who perform no other work, and they have reached a point of efficiency by concentrating on this one unit, so that they are able to complete a unit in much less time than would be the case if each foreman were compelled to overcome the difficulties common to this section.

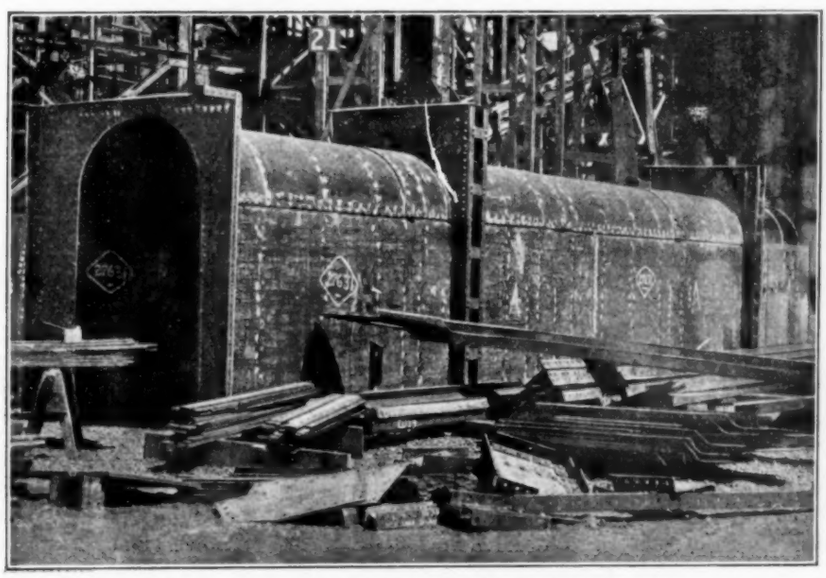


FIG. 8. SHAFT ALLEY READY FOR INSTALLATION

The bottom bounding angles and stiffener clips are riveted and the tank top calked before the shaft alley is placed on the ship.

The assembly of the shaft alley has proved a time-saving factor, from the standpoint of being able to proceed with the erection of the after end of the ship immediately after bottom bounding angles are driven. This is true from the fact that stanchions connect to the top of the shaft alley. These stanchions, strong beams and web frames cannot be erected until the shaft alley is placed on the ship. The erection of the stanchions, etc., permits proceeding with the erection of "J" strake plates, frames and girders, which erection opens up the erection of all other shell plate and second-deck beams, etc. If the shaft alley was placed on the ship piece-meal the erection of the alley could not begin until the bottom bounding angles were riveted and calked, as in the case of the assembled shaft alley. After the completion of the bounding angles the work

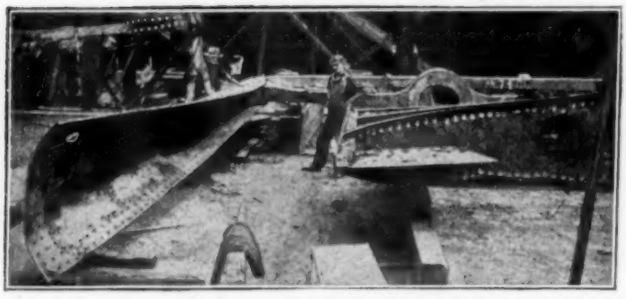


FIG. 10. ASSEMBLING STERN FRAMES

of slowly erecting the shaft alley in pieces would begin and until this was completed piece by piece, regulated, reamed and bolted, the stanchions, girders and frames, for holding up the after end, could not be erected.

It is important in this yard to push the erection of the stern end of the ship and it is only by taking advantage of each little point that this is possible. The shaft alley

FIG. 11. ANOTHER STERN FRAME

is the main and most important point in the speedy erection of this part of the ship. See Figs. 7 and 8.

THE STERN FRAME.—The stern frame is a one-piece steel casting weighing about 18 tons. Owing to the tidal conditions existing at this yard the shoe plate was assembled beginning with the 12th boat. On the 16th boat it was found that there could be assembled to advantage the B-1 shell plates and also frames Nos. 5, 6 and 7. All of this work was completely riveted on the ground at a tremendous saving in cost, which is only the natural result of not being compelled to shift men back and forth to this job when tide permitted work to be carried along. On the 22nd boat, bulkhead No. 8, C-1 and D-2 plates were assembled. No riveting was performed on the C-1 or D-2 plates, this work being left loose for fairing up. Beginning with hull No. 25, the assembly of this section has been extended by adding the boss plates. This permits the erection of the stern portion of the ship in a state of completion which permits the early completion of this end of the afterpeak, the early completion of boring out the stern tube, the early completion of fitting tube to shaft alley, which allows, at an early date, all machinery and shafting to be lined up right through to the condenser. The handling and placing of this unit is done in about one hour from the front of the slip. The work on hull No. 22 faired into the remainder of the ship very nicely, absolutely no additional work being required on this section. (See Figs. 9, 10, 11 and 12.)

FRAME NO. 91.—This frame is assembled with side plates of coal trunk and riveted complete in the assembly yard.

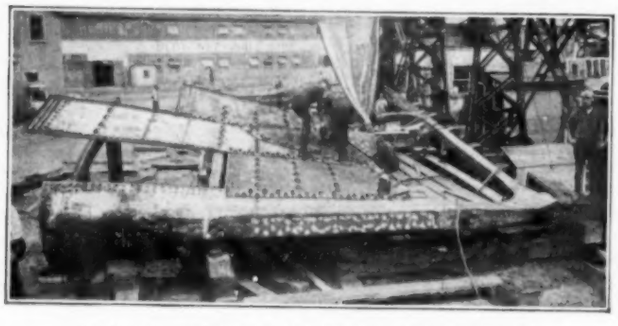


FIG. 12. PUTTING ON THE LAST TOUCHES

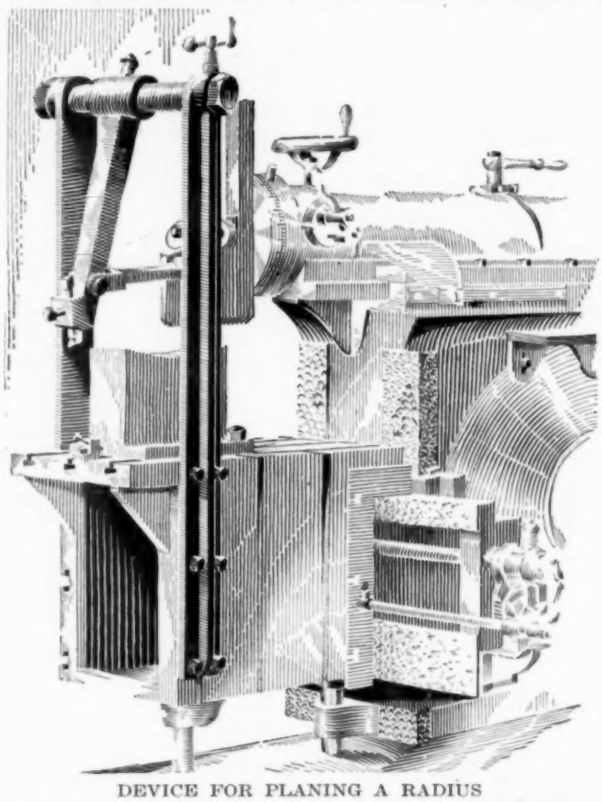
Planing an Arc on the Shaping Machine

BY HERBERT FOX

A curved surface of large radius is usually a difficult thing to machine unless the shop where it is done has a large boring mill available, but there are makeshift methods that can be used in the small shop by which such work can be accomplished—within limits. The illustration shows how it was done on a number of castings in one such shop.

The upright pieces were made for the job, as was also the swinging arm and the connecting-rod; but, if there should not be a sufficient number of pieces to be finished to warrant the expense of patterns and castings, these could be made up from cold-rolled bar stock and the expense avoided.

The uprights were bolted to the sides of the table and connected across the top by a shaft shouldered into the hubs and held by nuts. The middle part of



DEVICE FOR PLANING A RADIUS

the connecting shaft was turned to a running fit in the hole at the upper end of the swinging arm. The hub of the connecting-rod was made to take the place of the clapper, and was held by the same taper pin.

The distance of the center of arc above the base of the work was of course established when the uprights were bolted to place. Roughing and finishing cuts were provided for by using two tool bits, each abutting against a screw in the swinging arm. Wear and grinding on the finishing tool was compensated for by advancing this abutment screw, the radius being established and maintained by a special gage which hooked over the central shaft.

It was thought at first that trouble might develop from cramping of the swinging arm in its passage across the shaft and the oil cup was provided as a sort of insurance against it, but no such trouble developed; the device worked very nicely from start to finish and is ready for any similar job in the future.

A Progressive Indexing Jig

SPECIAL CORRESPONDENCE

This article describes how a job that looked at first as if it would require costly tools was finally accomplished with a few comparatively inexpensive ones. It is not always the wisest course to remove the limit to the tool cost entirely in order to expedite production; sometimes the quantity will not warrant it, and sometimes the nature of the product will require skilled labor to be used in its production anyway, regardless of the elaborateness of tool construction. In this latter case, it is not bad practice to make the skill of the worker count to its utmost against excessive tool cost.

A JOB that upon first consideration presented a rather formidable appearance and seemingly required the construction of somewhat complicated and expensive tools, came to the writer sometime ago. The work, which is shown completed except for the rollers in Fig. 1, is a cage or shell for a roller bearing, and is used in the bearings of a rolling mill.

Such bearings are, of course, a commercial product and the manufacturers of them probably have ways of producing the cages that have our method "skinned a mile." Nevertheless, as our firm had a large number of mills so equipped and the service was severe, resulting in excessive maintenance cost, they decided to attempt the construction themselves and the way in which our designer attacked the job was a study in simplicity, in which accuracy of workmanship stood in lieu of complicated and expensive devices. Briefly, he decided to depend upon progressive indexing, the bug-a-boo of so many tool designers, rather than to make costly tools that would provide independent indexing for each position.

Twenty-One Divisions in the Cage

So far as the cages were themselves concerned, absolute accuracy was not essential, but because of the cumulative effect involved in the method of production, an original error of even 0.0001 in. would have proved embarrassing. As may be seen from the drawing, there were 21 divisions in the cage, thus the original error would be multiplied by that number. The same tools were used to produce the cover, or binder-ring, in which the total error would be duplicated. Now as the cover must necessarily be inverted to put it in place, adding its accumulated error to that of the cage, the total error (assuming 0.0001 in. times 42) would prevent the two parts from going together.

The cages were cast from hard bronze in the form of cylinders. The first operation was to chuck them in a lathe, rough-turn (as far as the chuck jaws would allow), rough-bore clear through, face outer end, and then finish-turn to correct outside diameter, which must be quite accurate because of the method of holding in the succeeding operation.

The first special tool was an iron pot casting similar to those used for making piston rings, but heavier, and with a substantial flange so that it could be bolted to the faceplate of a lathe. The only machine work on this casting was to face the flange and drill the bolt holes to attach it to the faceplate and when it was properly swung up, to bore it to a push fit for the outside diameter of the brass shells. The shells were pushed into this holder with the tail-spindle screw and when finished could usually be pushed out with a rod through the lathe spindle used in conjunction with a piece of strap iron placed across the inner end of the shell. Sometimes, however, the operator would get too enthusiastic in pushing the work in, in which case it became necessary to dismount the whole business to drive the shell out. The set-up is shown in Fig. 2.

With the shell in this holder, the remainder of the outside surface (where the chuck had gripped it in the first setting) was finished and this end faced. A light finishing cut was then run through the bore, and here again good work was necessary as in the next set-up the shell became a part of the indexing jig.

This may sound like excessive refinement in the preliminary operations, but it did not seem so while doing it. No part of the job was exactly work for unskilled labor and with an average man on the job the work went foward rapidly and without undue trouble. It was not necessary to send the shell clear home in the holder to do the finish-boring; it must not be loose or it would not drive, but if it was a "leetle too tight" we didn't push it in so far, and if it wouldn't go in far enough to make it safe to work on, it was chucked in another lathe and filed. This extra chucking as well as the dismounting of the holder to drive out a shell that had been too tightly forced was hard work, and after trying both a few times the workman decided it was easier to make them right the first time.

The Tools Used

In Figs. 3 and 4 are shown the few simple tools used to cut the roller cells. The work was all done in an ordinary drilling machine. The base *A*, Fig. 3, was of cast iron with a hardened-steel ring shrunk on the shoulder, over which the brass shell sets. The cover *B* was of machinery steel with a shoulder tightly fitting the inside of the shells. Twenty-one semicircular notches in the periphery of this cover were made to correspond to the roller cells, but these had no part in the indexing, being merely for clearance in the counterboring operation.

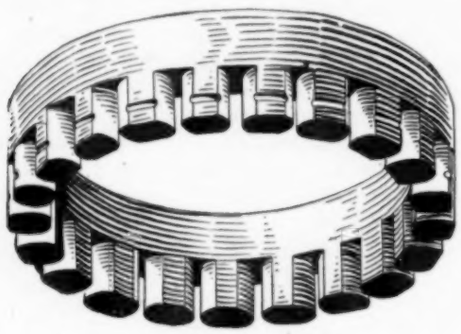
Each of the projections extending between these notches had a hardened center-point sunk into its under surface for the purpose of supporting the upper ends of the slender finger-like dividers that was all that remained of the shell after the counterboring was finished. A ring nut upon the central stud clamped the cover tightly onto the shell and held the whole together as one unit.

A sector *C* made of cast iron with three steel bushings, swung upon the central stud and could be clamped in any position by the hand nut *D*. One of the two outer bushings was larger than the largest tool used and was fitted with slip bushings to accommodate all tools. Two plugs *A* and *B*, Fig. 4, were fitted to the other bushing—*A* having an extension to fit the hole left by the drill, and *B*, a hole to fit over the post made by the hollow mill *C* when making the cover.

The first operation was drilling 21 holes in the shell. The drill was of such size that it did not cut through

the metal and as the drilling was done in four stages, starting with a short drill and using progressively longer ones as the depth increased, there was little tendency to "run."

Starting the operation by setting the sector to drill approximately to the center of one of the clearance spaces in the cover, a hole was run down to the limit of the drill. The sector was then set forward until the double plug would pass through its bushing and



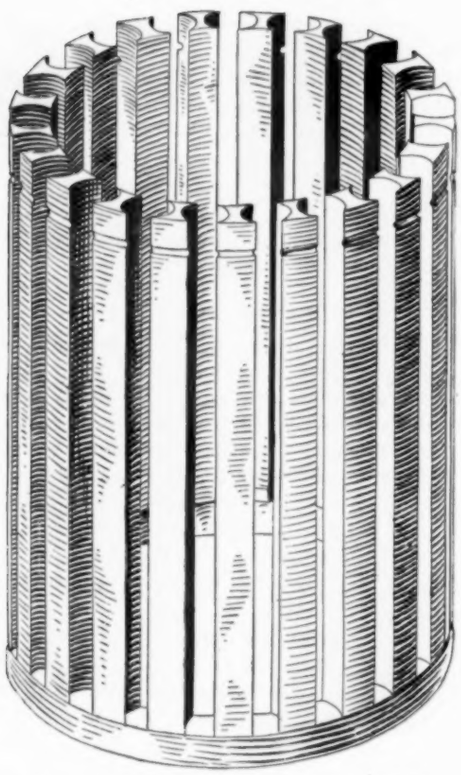


FIG. 1. ROLLER CAGE AND COVER

into the hole just drilled, the sector then being in position to drill the next hole.

For the reason that the center distance between holes in the finished cage would be too short to accommodate proper sized bushings, the center distance between the bushings had been carefully calculated to equal the chord of arc intercepted by every other hole so that the second hole drilled would be in the position of the third after finishing, leaving a blank space where the second should be. Thus, the eleventh hole drilled would be adjacent to the first one and on the sector's second time around the blank spaces would all be drilled out.

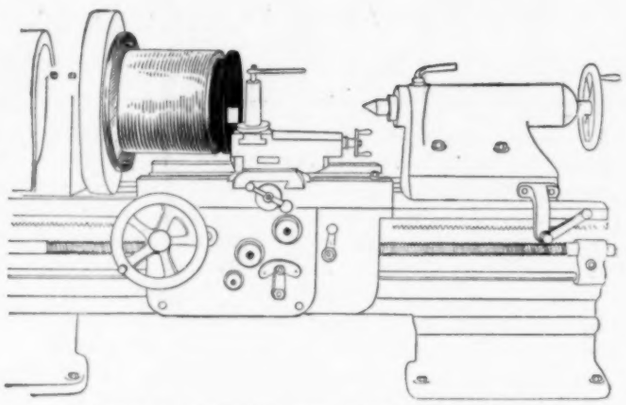


FIG. 2. HOLDER FOR FINISH-BORING

After all holes were down to the limit of the first drill, the sector was of no further service. The holes were then put down to the full depth of $8\frac{1}{2}$ in. in three succeeeding operations. A special counterbore with a pilot closely fitting the drilled hole and a body equally closely fitting in the counterbored hole now followed the drilling. As this counterbore was $\frac{1}{32}$ in. larger than the rollers to be used in the cage, it naturally "cut out" both inside and outside of the shell, but because of its peculiar shaped spiral cutting edges and closely fitting body, no trouble was experienced by reason of its running or drifting out of line. A second counterbore, a duplicate of the first except that it had no pilot, finished the holes to the required depth, leaving the bottom square and clean.

After the first hole was counterbored, the necessity for the prick points on the under side of the cover

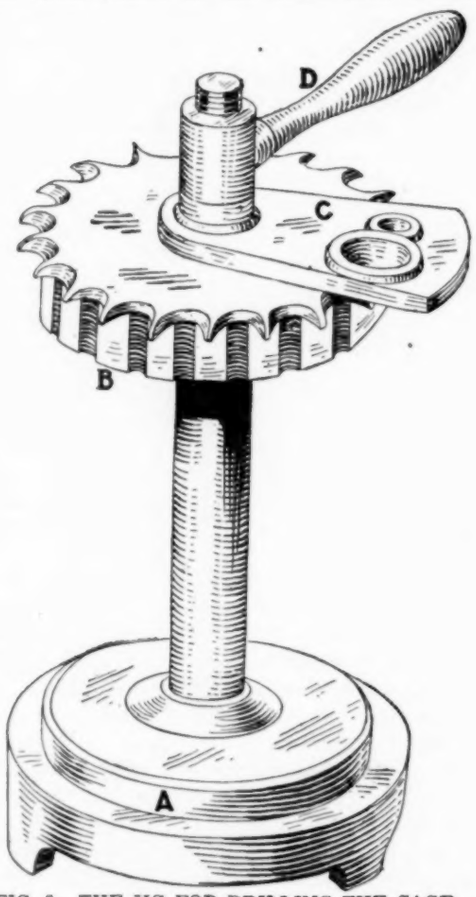


FIG. 3. THE JIG FOR DRILLING THE CAGE

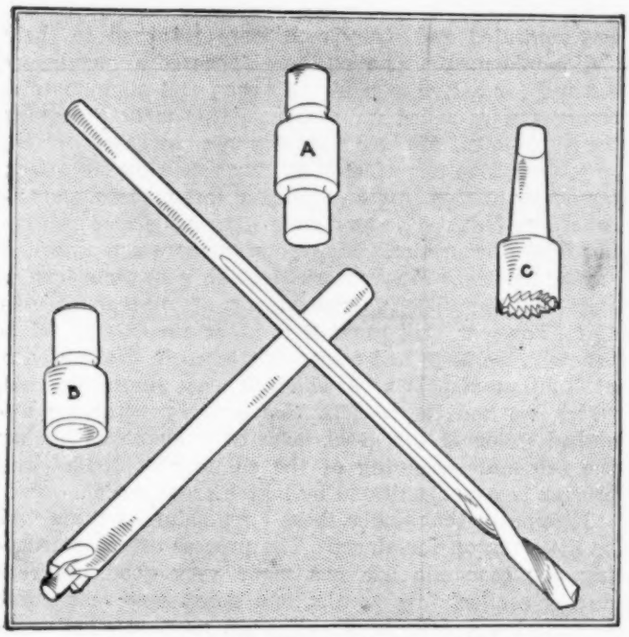


FIG. 4. TOOLS USED IN MAKING THE CAGE

became apparent, as upon counterboring, the second hole on the side toward the first, being only a slender finger of brass 8¾ in. high, would tend to spring away under pressure of the cut and not only bind the counterbore but would cause the latter to "drift" out of alignment. It was necessary, in spite of the prick points, to follow up the counterboring operation by keeping pieces of drill rod in three or four holes following the counterbore, stepping them along as the counterboring proceeded, to counteract that tendency.

The same base and sector were used for making the binder-ring, a shorter center stud being substituted and the cover omitted. As the binder-ring fitted the shoulder and projected but ⅜-in. above it no other hold was necesary. The short posts were made by the hollow mill which was indexed forward in exactly the same manner as previously described for the cage, using the hollow plug for an indexing pin.

The binder-ring was now set in place on its cage and the ⅜-in. projections tapped into place by using a mallet or a ball of lead. The cage was then mounted on an expansion mandrel and a round-bottom groove cut clear around in the solid metal, part of which was the cage and part the cover. The location of this groove may be seen in Fig. 1.

Next, taking off the cover, the hardened-steel rollers were dropped in, the cover replaced and a piece of iron wire just long enough to go around the cage was tapped into the groove, the metal being swaged over the joint to prevent the wire from coming out.

I do not remember the time required to complete one of these cages, but if the manufacturers can remove material any faster than we did from work so fragile as the cages became as soon as two or three cuts had been made, I am interested to know how it is done.

Peace and the American Machine-Tool Industry

By L. W. ALWYN-SCHMIDT

What effect will peace have on the machine-tool industry of this country? At the time of writing, the meager data at hand does not allow one to build a conclusive answer to the question. However, the happenings of the past few months have provided tangible ground work on which to form the nucleus of the solution.

THE American machine-tool industry had grounds to look with apprehension to the coming of peace. The years of the war had been marked with unusual activity and machine-tool exports had not only grown at an unprecedented rate, but there was also an enormous demand from the home market. The extent of the latter can only be estimated from the fact that the employment of labor had more than doubled.

Discussion of measures to be taken to meet the cessation of the so-called industrial war activity was complicated by the utter lack of precedence. It was calculated that most of the machine tools manufactured for the production of war material would not be suitable for other work while only a few could be rebuilt for other purposes. The manufacturers of war material had foreseen this possibility and had made their prices accordingly, which provided for the depreciation of new machines and the buildings that were erected. The wisdom of this practice has shown that the loss will be small even if the machinery that was built for special purposes eventually goes to the scrap heap. In fact there is a fair likelihood that many machine shops have written off so much of their machine equipment as to have on hand an actual surplus cash reserve that may be employed for new purchases. At any rate, plenty of warning had been given of the approaching armistice and during the latter part of October it was rumored that fewer orders for shells might be expected. Foreign orders for equipment also had been tapering off for some time, so that the industry had ample time to consider its position even before the date of actual cessation of hostilities.

The reorganization of the industrial forces of the industry, which is the important work at present, is now proceeding more smoothly than might have been expected. There is no cause to assume that the domestic demand for industrial products has decreased materially during the first months of peace. If this continues it is certain that the machine-tool industry will get its deserved share in the general prosperity; if it fails it is bound to suffer with all the others.

It was the opinion of some that our prosperity would end with the advent of peace and in support of their argument, claimed: that our war prosperity was created by the war only and consequently would end with it; that after the war, Europe would regain her position in the world's markets, thereby excluding the American manufacturer; and that a general financial panic would be the result of the war.

Let us examine each of these assumptions and see how far the actual events have proved their correctness.

The war was certainly the outward cause of much of our prosperity, and had it ended two years ago, it might have put an end to the prosperity created. The

additional two years, however, changed the situation materially, and our national industry is working today under conditions very different from those existing during 1916. Considerable money has come into the country, wages are higher, and business is continuing at a brisk rate in all lines. Prosperity has set in and it is going to stay. The reëstablishment of normal conditions in Europe, while not as powerful a factor in reconstruction as expected, will stimulate the export business and without a doubt the machine building industry will get its share. Incidentally, our exports to other countries depend not only upon the industrial activity of Europe but upon our own ability to supply their demand.

Statistics show that the machine industry of this country, in spite of losing the large orders of war material, is rapidly gaining its former foothold with the reëstablishment of normal demands for equipment. Many orders, for instance, are expected from the agricultural machinery industry. This industry has not done an extensive export business during the last few years, but there are indications from Europe that more American agricultural machinery will be used after the war than before. France and Russia especially should become large buyers and this, added to the usual demand from all the other markets together with our own home market, should tend to increase the activity in the American agricultural machinery industry to such an extent that it will be compelled to increase its machine-tool equipment.

While this reorganization process is going on at home we can hardly lose sight of the corresponding development in other countries, competitive and buying. In reorganizing her industries, Europe will be favored in one respect against America. The European nations have lived for many years under considerable stress. The experience of the war has taught them that only coöperation can solve the many difficulties incidental to peace, and they are, therefore, more inclined to support the respective propositions of their governments.

With the business of the machine makers returning to its normal channels a number of new problems have arisen, affecting the individual manufacturer. The unsound pressure under which production was carried on has not been pleasant. Unusual expansion of the industrial equipment was necessary and many new firms were organized which have increased competition, and sales departments are working harder to meet the high level of expenses incidental to advertising, selling, wages, overhead and materials. Before the war, machinery prices were kept at a low level by European exports in spite of the high prices charged by American manufacturers. Since neither England nor Germany will be able to manufacture machinery as cheaply as before, due to the fact that wages in Europe are steadily approaching our standards and their manufacturing methods are not equal to our own, foreign machine prices, therefore, will remain near our level. While the foregoing, together with the disposition of enormous quantities of raw materials, new and going war industries, and possible competition with Latin America and the Orient, presents problems which are being rapidly solved, yet the biggest problem on our hands is the disorganization of labor.

With the declaration of war in Europe, a great many men were drawn into the army who were much more needed at the lathes and benches than in the trenches. With the progress of the war, however, this mistake was remedied and many men were returned to their civil employments. Later, there appeared a very heavy demand for active men in the army, and all industrial reserves were called for service. This made necessary the employment of older men, and in many cases women, in the machine manufactories. By following the lesson taught by Europe, America avoided this mistake and the American industry is now assimilating the men returning from the armies. Many men and women who had paying positions in war work are taking up their former employments. The unemployment of discharged soldiers, however, still prevails to a certain extent. Fortunately, we have had some experience in dealing with a situation of this kind which is very similar to that which we had to meet in this country when we absorbed suddenly the great mass of unemployed during the fall and beginning of the summer of 1915. The process is now facilitated by better organization.

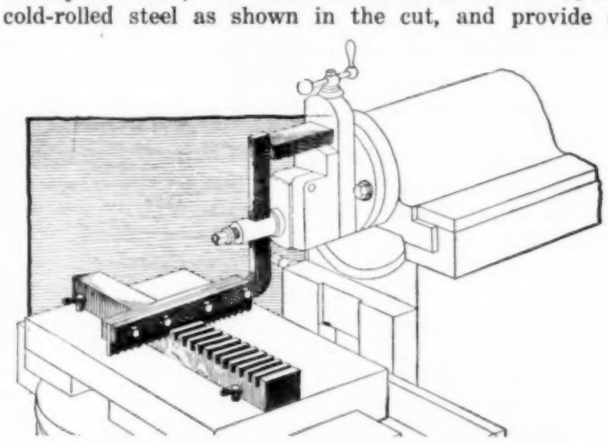
It appears that under these circumstances there will be little reason for alarm. The process of reconstructing our economic life has made very good progress during the last few months, and there is no reason yet to expect a sudden hitch, although an occasional slowing down or friction in one direction or another is to be expected. It is not easy to adjust a vast industrial equipment like that of the United States from one purpose to another. It took over a year to concentrate our whole economic energy upon the conduct of war, so we must not expect an immediate return to the conditions of peace. The machine building industry being so closely allied to all national industrial activity will soon feel the effect of the new situation.

The war prosperity of this industry has ended but it has been replaced by a new prosperity of returning peace and at the time of writing there is nothing to trouble the mind of the machine-tool maker in this country. The present activity in the industry should be easily upheld and there are a great many indications in favor of the theory that it may become more pronounced during the new year.

Tool for Making Narrow Slots

By J. A. Lucas

When it is necessary to make a slot or series of slots so narrow that the ordinary form of parting tool is impracticable, draw out and bend a bar of 1½-in. cold-rolled steel as shown in the cut, and provide a



SLOTTING WITH PIECES OF HACKSAW BLADES

clamping jaw into which is tapped several collar-head or ordinary hexagon head capscrews of small size. Broken hacksaw blades furnish the cutting tools.

"MEPHISTO" BITS HOW THEY ARE MADE

By S. A. Hand, ASSOCIATE EDITOR, AMERICAN MACHINIST

The manufacture of auger bits is one of the oldest of the tool industries in this country. Many of the factories have remained in the families of their founders for generations and, as is usual in such cases, radical improvements in either the product or the processes of manufacture have been slow. The bit described in this article has been improved, not by adding anything to it but by taking something from it. Some of the processes in its manufacture are different from those generally used in bit making. Boring is only whittling in a circle and just as one uses only one blade with which to whittle so it is only necessary to have one cutting blade on an auger bit. Likewise, it is only necessary to have one scoring lip to cut off the chip.

THE steel used in the auger bits made by the W. A. Ives Manufacturing Co., Wallingford, Conn., is made to its own specifications using genuine Swedish pig as a base. It has a slightly higher content of manganese than of carbon, to give stiffness; while for endurance of cutting edges, a trace of tungsten is added.

The blanks for the bits are sheared from a flat bar of suitable size, and after being heated the shanks are drawn out and the squares formed in dies in high-speed Bradley hammers as may be seen in Fig. 1. Next, the blade is die forged in the same type of hammer. In this operation, known as plating, the blade is left thicker at the center than at the edges, the shape being similar to that of a slitting or feather-edge file. This shape is not carried out to the extreme end, a blank space about twice as long as the width of the blade being left for drop-forging the leader-screw blank and scoring lip and to leave enough thickness of metal for forming the cutting lip. The appearance of this end after drop-forging may be seen in Fig. 2, in which *A* is the blank for the leader screw, *B* the scoring lip and *C* the part from which the cutting lip is upset. It will be noted that an unusually large flash is left from the drop-forging operation. This is to insure the maximum compression of metal at the vital part of the bit and to make certain that any accidental overheating of the metal at the edges and extreme end will not affect the cutting parts. Trimming off the flash is done in an ordinary punching machine provided with suitable dies.

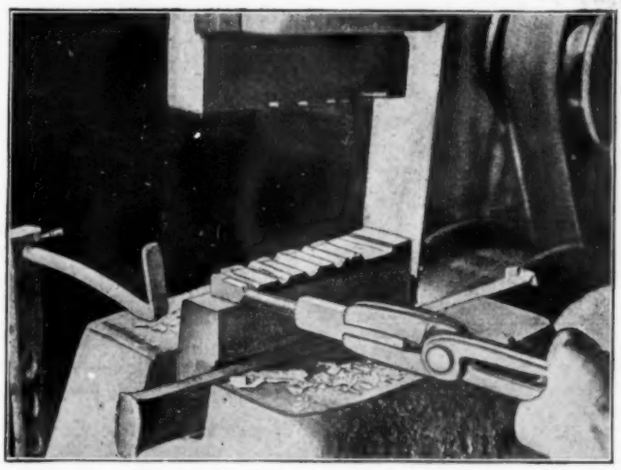


FIG. 1. FORGING THE SHANK

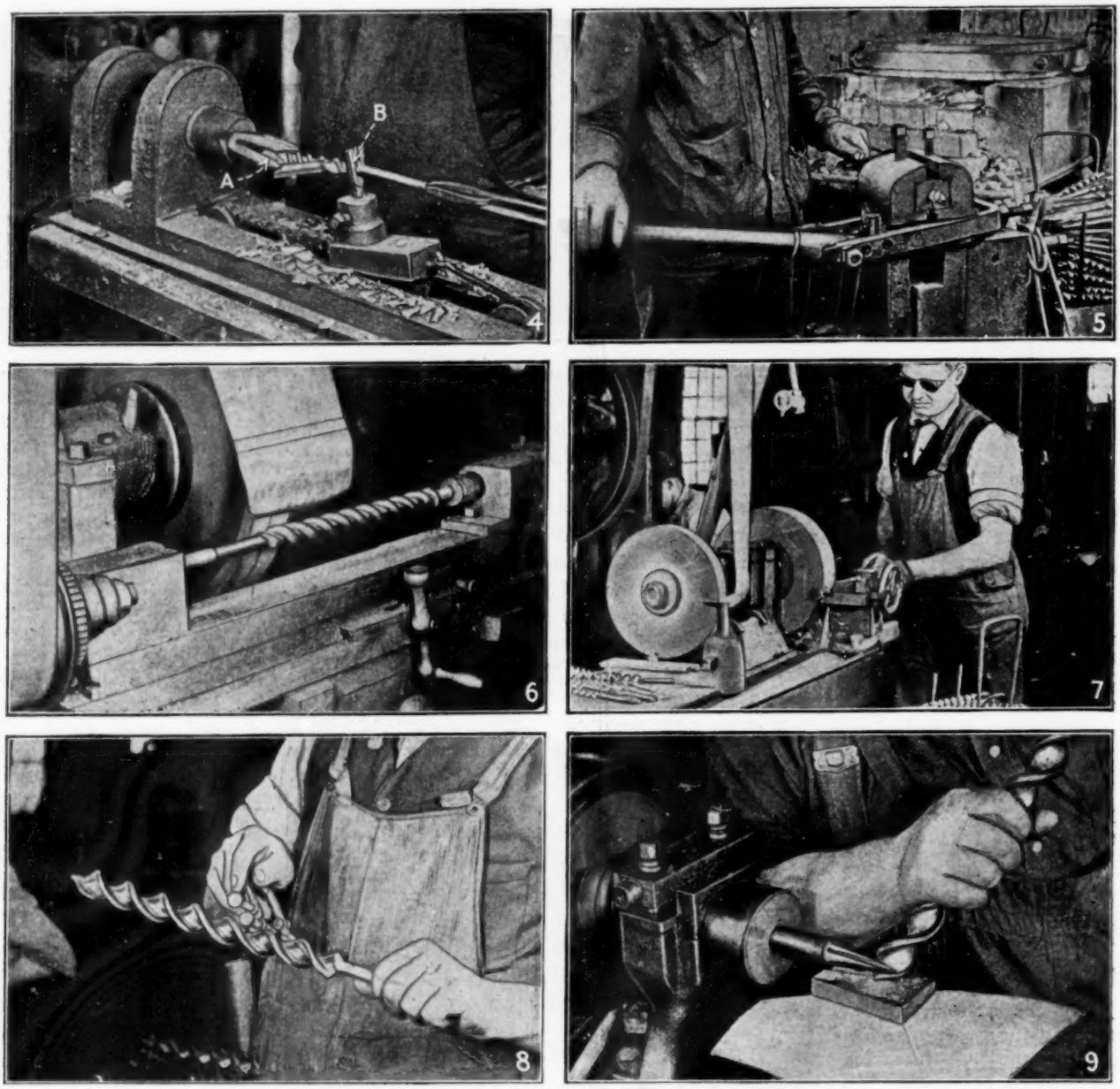
The appearance of the bit blank after it has gone through the operations described is shown in Fig. 3. *A* is the blank as cut off by the shears; *B* has the shank drawn out and the square formed; *C* shows the blade after plating. Here the thickened center and the flat at the end left for drop-forging may be seen. *D* shows the result of the drop-forging operation, and *E* represents the appearance after the flash has been trimmed.

Crimping or twisting the blade is illustrated in Fig. 4. The cutting end of the hot blank is inserted in the chuck *A*, the rear end of the blade being supported in the fork *B* while the square on the shank is held by tongs in the operator's left hand. With his right hand, the operator turns a crank connected to the spindle of the machine. Twisting is continued until in the judgment of the operator the number of turns and the lead are correct, no hard-and-fast rule being followed. Operators on this work, however, become so expert that the results are very uniform.

Bits for boring treenail holes in wooden-ship construction and for other deep-hole work are not twisted but are crimped between dies in a machine of the bull-dozer type. Such bits must have the bottoms of the crimps accurately formed so that the chips will be brought out of the hole and not clog the bit.

After twisting, the bit is reheated at the end and headed. In this operation both the cutting and scoring lips are formed in dies, the action of the machine being similar to that of a bolt-heading machine. The next step is to even up the twist between dies in the lever-operated fixture, Fig. 5, after which the bit is cold-straightened.

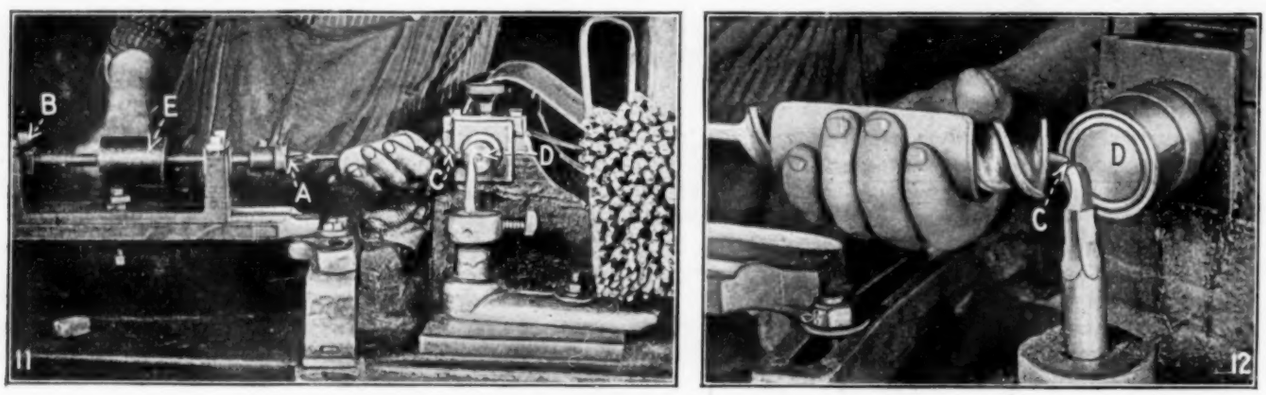
The blank for the leader screw is hollow-milled to size and shape in a hand lathe and the outside diameter is ground to size. In this latter operation the bit is held in a chuck in the live head of the machine, Fig. 6, and supported at the other end by a female center into which



FIGS. 4 TO 9. TWISTING, SIZING AND THROATING

Fig. 4—Twisting the bit. Fig. 5—Evening the crimps. Fig. 6—Grinding to size by a friction wheel. Fig. 7—Grinding the clearance. Fig. 8—Measuring the clearance. Fig. 9—Digging out the throat.

the blank for the leader screw fits. The action of the machine is similar to that of any cylindrical grinding machine except that the actual grinding is not done by an abrasive wheel, as would naturally be supposed, but by a steel wheel running at a very high peripheral speed. The removal of metal from the bit is by fric-



FIGS. 11 AND 12. CUTTING THE LEADER SCREW

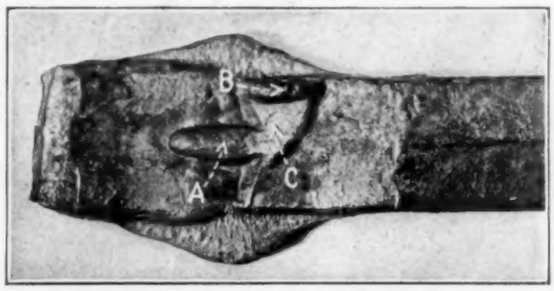


FIG. 2. THE DROP-FORGED HEAD

tion. There seems to be little wear on the wheel which is evidenced by the fact that the wheel now on the machine has been in constant use for about 17 years. The outside of the bit must be reduced in diameter behind the cutting point for clearance and the operation is performed, as shown in Fig. 7, on an ordinary abrasive grinding stand, the bit being revolved by hand between the abrasive wheel and an adjustable slide. Fig. 8 shows an inspector gaging the clearance with an adjustable limit gage.

Both the cutting lip and the blank lip opposite to it are faced back to form a tangent with the leader-screw blank and their tops are leveled off, all on hand milling machines. The throat under the cutting lip is "dug out" by milling to form the chip carrier. This operation is illustrated in Fig. 9, in which it will be noticed that the bit is being guided entirely by the workman's hands.

Various Stages the Bit Passes Through

Fig. 10 shows the stages the bit has passed through from the crimping until it is ready for cutting the thread on the leader screw. Referring to the illustration: *A* has been crimped; *B* has been headed and the blank for the leader screw hollow-milled; *C* has been ground on the outside and for clearance; *D* has been faced back; *E* has been leveled on top, and *F* has had the throat dug out.

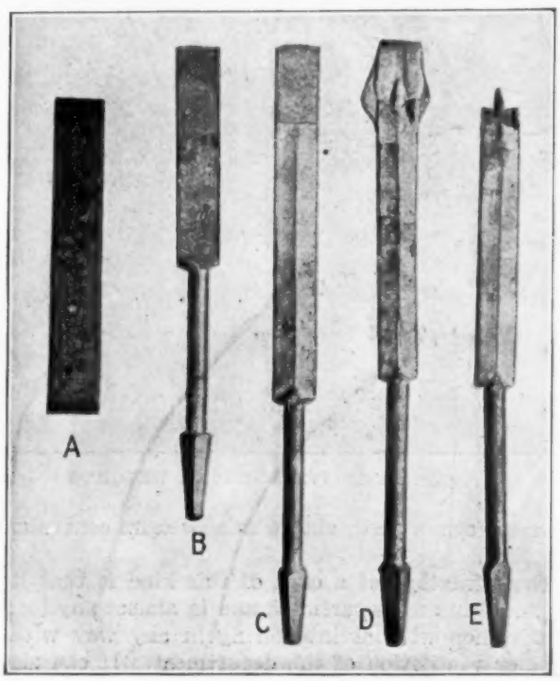


FIG. 3. OPERATIONS BEFORE TWISTING

Figs. 11 and 12 show how the threads on the leader screw are formed. The square shank of the bit is held in the chuck *A*, Fig. 11. The spindle supporting this chuck is threaded at its rear end to the same pitch as the screw to be formed and is free to revolve in the nut *B* which also acts as a back bearing. The leader-screw blank is supported by the rest *C* and drawn up by hand against the concentrically grooved steel disk *D* which

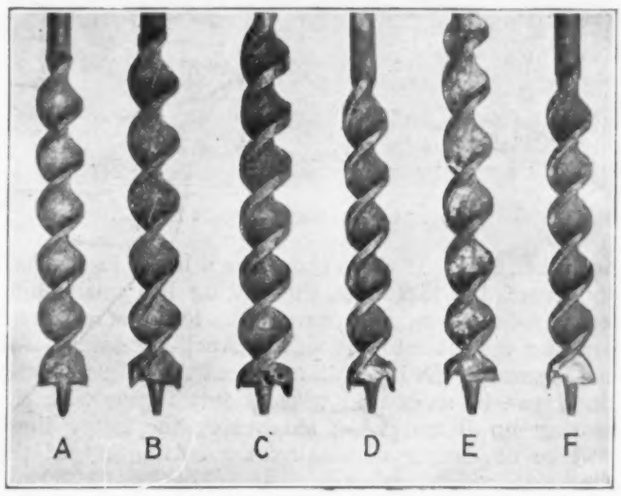


FIG. 10. SOME OPERATIONS AFTER TWISTING

runs at 8000 r.p.m. While the operator holds the leader-screw blank tightly against the disk with his left hand he rotates the spindle in one direction by rolling his right hand and arm over the wooden roll *E*; and

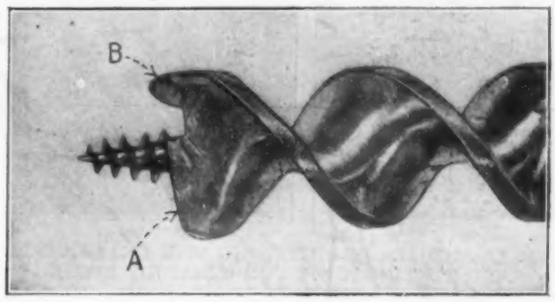


FIG. 13. A FINISHED LEADER SCREW

then relieving the pressure, rotates the spindle in the opposite direction by a reverse motion of his hand and arm, lead being given to the screw by the thread and nut at the rear. The thead is formed by friction between the leader-screw blank and the rapidly revolving disk and during the operation the leader-screw blank becomes red hot.

Relation of Leader Screw to Cutting Lip

Bits are made with leader screws of different pitches —varying from 10 per inch for bits used by electricians, where the object is to bore a hole quickly without regard to its smoothness, to 18 per inch for bits used by pattern and cabinet makers and for use in power-driven machines.

A finished leader screw is shown in Fig. 13 where it will be noticed that the cutting lip *A* is a continuation of the last thread. This construction is the secret of making a bit that will bore a hole clear through a board without requiring end pressure after the screw

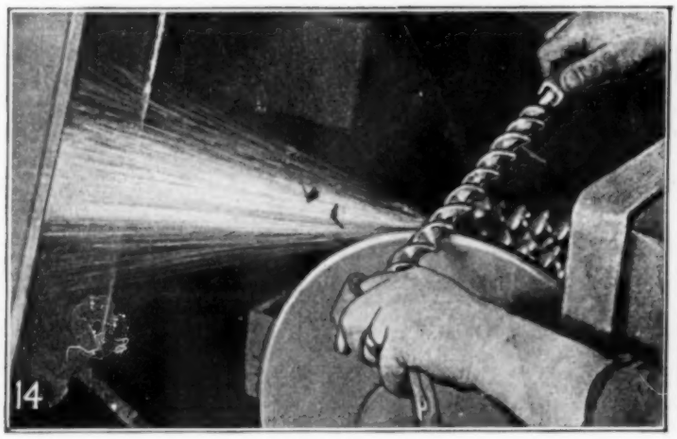


FIG. 14. POLISHING THE HOLLOW

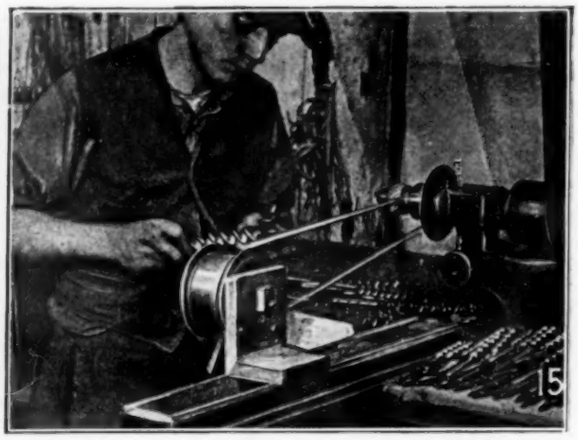
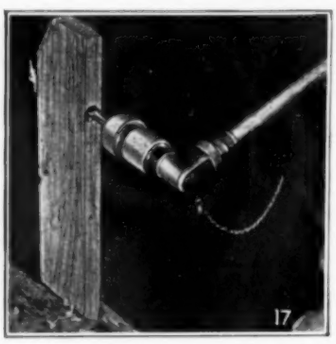


FIG. 15. POLISHING THE THROAT

has taken hold. If there should be a break in the continuity of the thread to the cutting lip, small chips would lodge there, and prevent the leader-screw from drawing the bit into the wood. Another feature that can be seen in the illustration is that the single cutting lip *A* can be sharpened without interfering with the scoring lip *B* and when sharpening the latter there will be no danger of nicking the cutting lip of the file.

Several more operations are necessary before the bit is hardened and tempered, but as they are mostly such operations as are generally performed in every-day practice only two of them are illustrated. Fig. 14 shows how the hollows in the twist are polished on a vulcanized abrasive wheel and Fig. 15 illustrates finishing the throat on an endless abrasive belt.



FIGS. 16 AND 17. BRIGHTENING THE LEADER SCREW AND TESTING A BIT FOR STRAIGHT BORING

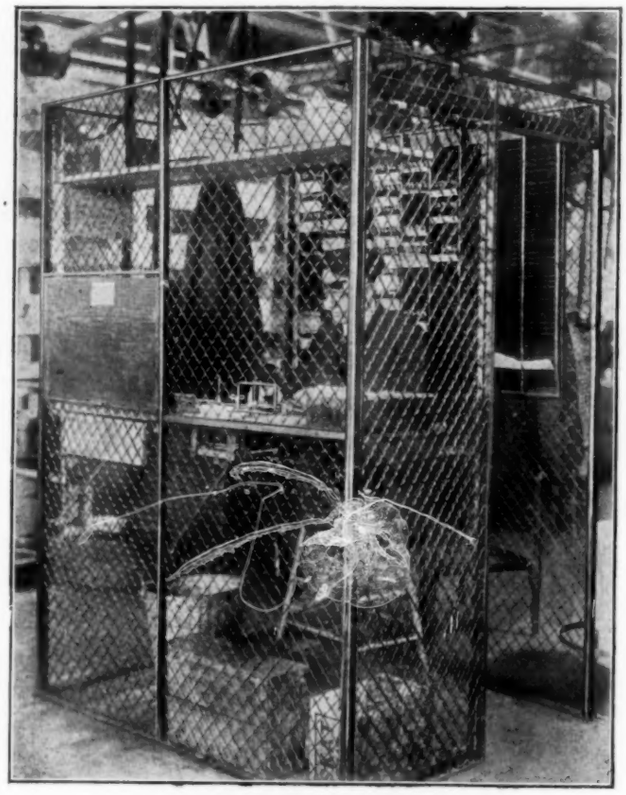
After hardening and drawing the temper, each bit is honed and carefully inspected. The leader screws are then polished by dipping them in oil and an abrasive and repeatedly screwing them in and out of a piece of apple wood as may be seen in Fig. 16. Every bit is tested in actual boring, and as a proof that a well-made bit will bore straight, Fig. 17 shows a bit finishing the boring of a $\frac{15}{16}$-in. hole edgewise through a 1-in. board.

Timekeeper's Cage

BY FRED H. COLVIN

The illustration shows the method used by the White Tractor Co., Cleveland, Ohio, for locating the routing or job-distribution office in any part of the shop which may be most convenient to the work. This cage, as can be seen, consists of practically standardized sections of heavy wire netting, including a sliding door, which is provided with a lock to prevent the cards or other records being maliciously or mischievously disturbed.

This cage contains the rack for the job tickets and also a calculagraph for recording the time of starting and stopping the various jobs. The small opening in front of the timekeeper is large enough for the passage of job tickets, while the board at the left can be let down to form a shelf, should this be more convenient at any time.



A CAGE FOR TIMEKEEPING RECORDS

The advantage of a cage of this kind is that it can be placed in any department and in almost any location in the shop without interfering in any way with the light or ventilation of the department. If can also be moved whenever desirable.

The Manufacture of Incandescent Lamps—II

By C. W. STARKER

A high degree of skill and a steady hand are required in assembling incandescent lamps. Improvements in both methods and materials in manufacture have been many and great. Since 1879 the efficiency of the incandescent lamp has been increased nearly fifteen fold and the lamp is now five times as efficient as it was at the beginning of the present century. Lamps must be thoroughly tested before shipping—many of them to destruction—and this entails an enormous annual expenditure.

TO BRING a modern incandescent lamp to its completed form a variety of materials and a number of operations are required. The principal parts of the modern tungsten lamp are shown in Fig. 17, and their names indicated.

The filament is supported on a glass mounting called the stem, which is made by cutting a glass tube to the required length and flaring the end, as shown in Figs. 18 and 19. Next a glass rod is cut off and provided with bulges *B*, Fig. 20, the one near the bottom, the other near the top. All these operations are done in practically automatic machines, the glass being heated until it becomes soft enough to permit the staving operation. This stem is then assembled with the glass tube, the leading-in wires brought into position, and, after heating, the base is flattened, as shown in Fig. 20 at *C*. As a next step the wire supports, or anchors, at the top and bottom on which the filament is to be hung, are melted in and insulated from one another by the glass parts. After inserting the anchors the proper diameter of tungsten wire for the filament is selected, depending upon the amperage desired, and cut to length according to the voltage for which the lamp is to be used. One end of the filament is joined to a leading-in wire and wound back and forth until its end meets and is connected to the other leading-in wire. This gives what is known as the complete mount, Fig. 21. The connection between the filament and the leading-in wires is made by melting the ends of the wires together in an electric arc in a special apparatus that provides a reducing atmosphere to prevent oxidization. The anchors are made either of molybdenum, tungsten or a wire containing 10 to 15 per cent. tungsten with the molybdenum. They are formed in automatic machines designed for rapid production in large quantities.

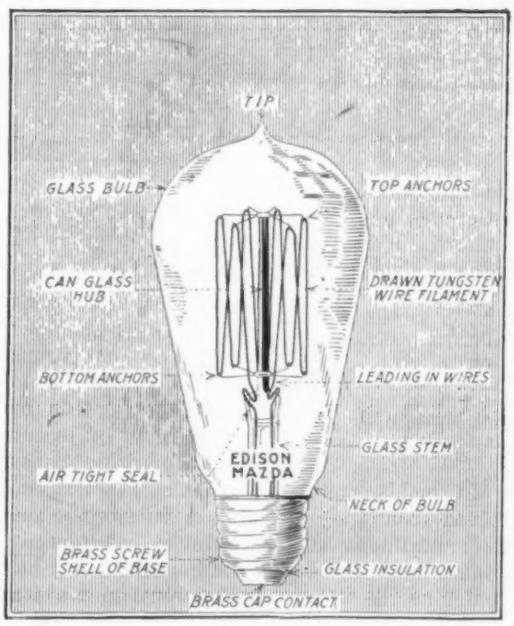
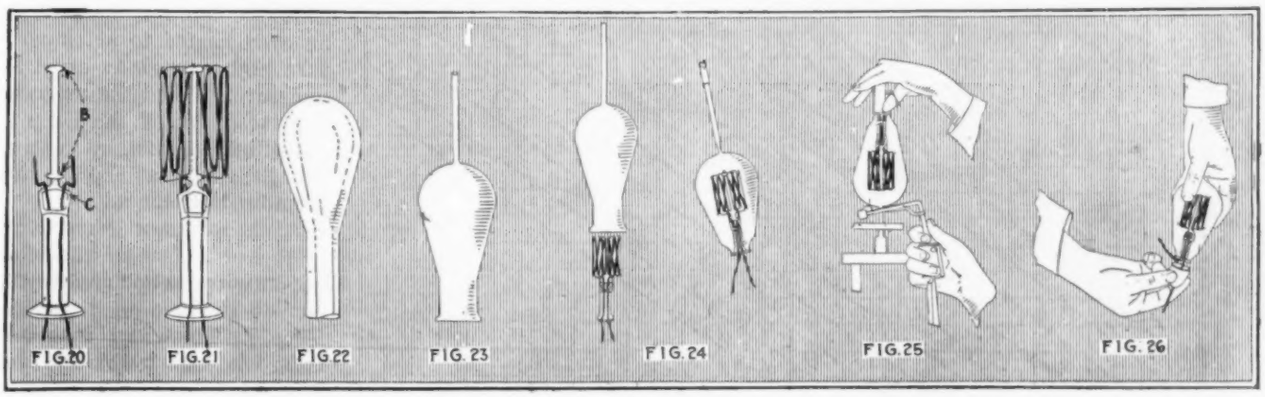


FIG. 17. A TUNGSTEN LAMP –

That part of the leading-in wire which is melted into the glass must have the same coefficient of expansion as the glass and must not easily form an oxide coating as otherwise air openings or breaking of the glass would occur. Such a material is platinum, a short piece of which is inserted between the two pieces of nickel and copper wire which compose the rest of the leading-in wires. Less expensive substitutes for plat-



FIGS. 20 TO 26. LAMP PARTS AND THEIR ASSEMBLY

Fig. 20—The finished stem. Fig. 21—The completed mount. Fig. 22—The bulb as it comes from the glass works. Fig. 23—The tubulated bulb. Fig. 24—Sealing-in the filament. Fig. 25—Exhausting and sealing. Fig. 26—Applying the base.

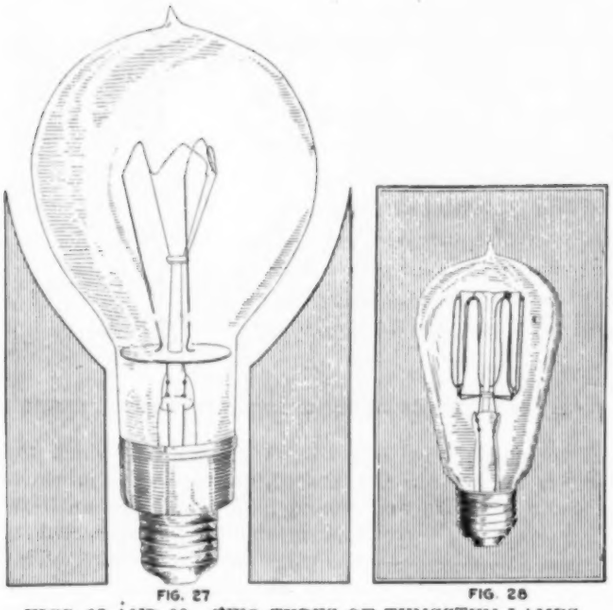


FIG. 27 FIG. 28

FIGS. 27 AND 28. TWO TYPES OF TUNGSTEN LAMPS
Fig. 27—A gas-filled lamp. Fig. 28—An exhausted lamp.

inum have come into use, such as nickel-steel wire covered with platinum.

The manufacture of the bulbs is a complete industry in itself, requiring large plants and skilled glass blowers. Formerly lamp bulbs were blown in the open, which naturally resulted in variation in size. Now,

FIG. 18 FIG. 19

FIGS. 18 AND 19. THE GLASS STEM
Fig. 18—The stem flattened. Fig. 19—The stem flared

however, the bulbs are all made in molds and are therefore of uniform size. As received from the glass works the bulbs have considerable superfluous glass, Fig. 22, which is cut off by the lamp manufacturer. This is done on a semiautomatic machine, in which a number of bulbs are set up in a circle and made to revolve around their axis as well as travel around in the circle. They are set to correct height, and in their rotation they pass a cutting wheel which makes a slight scratch in the glass, and then they pass a series of gas flames directed at the point that has been scratched

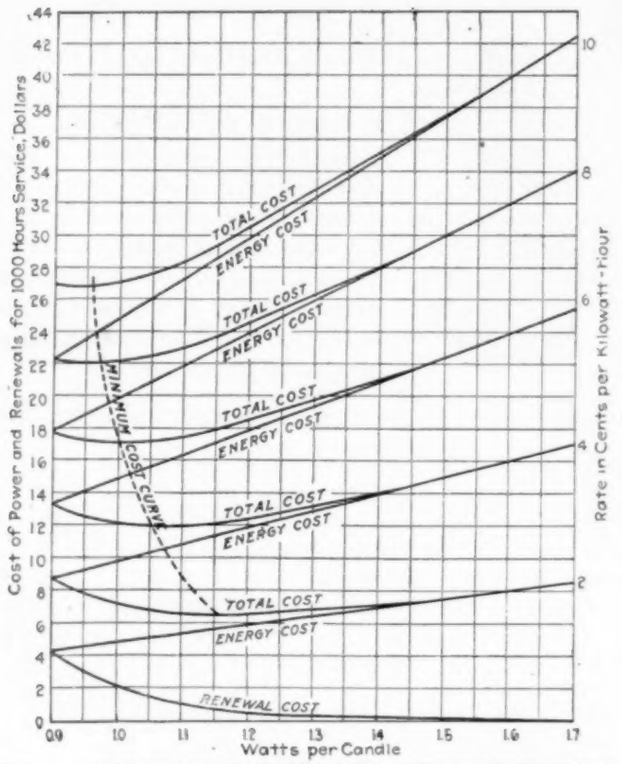


FIG. 31. RELATION OF ENERGY TO COST OF RENEWALS FOR LAMPS OF DIFFERENT EFFICIENCY

so that, due to the heat, the necks break off. Such machines perform this operation at the rate of 1000 or more bulbs an hour.

The next operation, Fig. 23, consists in melting a hole in the rounded end of the bulb and welding a glass tube at this point. The two operations of melting a hole and of inserting the tube are performed in the same machine, both tube and bulb being heated at the point of junction and brought into the proper position. Next follows the sealing-in process, in which the tubulated bulb is placed over the completed mount, Fig. 24, both parts being held in their proper relative position. Bunsen flames are applied at the neck of the bulb and both the bulb and the mount are rotated slowly until the neck of the bulb is welded to the flare of the stem tube. The seal thus formed at the neck of the bulb must be absolutely air tight.

In the next operation the exhaust tube is connected to a vacuum pump and the air exhausted from the bulb. While this is being done the lamp is inclosed in an oven heated to a temperature high enough to expel all moisture. When the exhausting is completed the lamp is sealed off, Fig. 25, by melting the glass tube at the top and forming the pointed tip.

After exhausting the lamp is "based." One of the leading-in wires is soldered to the cap at the end of the base, Fig. 26. This cap is insulated from the shell by black glass. The other leading-in wire is soldered to the brass shell and the socket cemented in place.

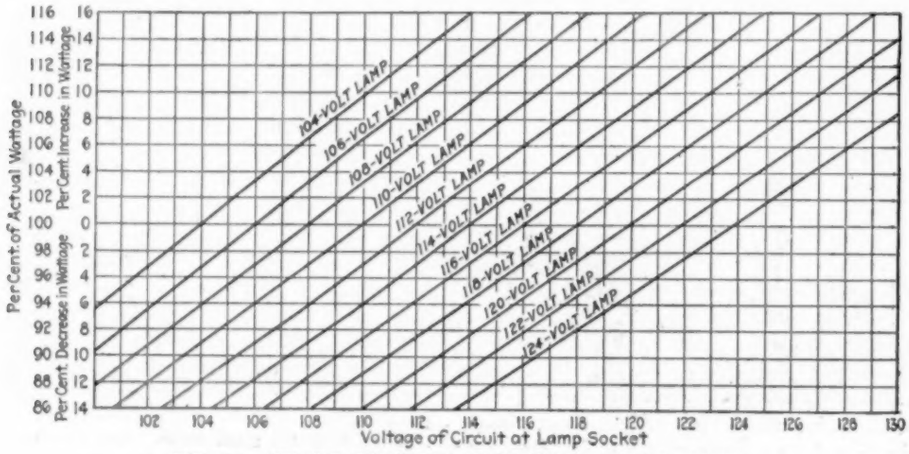


FIG. 29. CHART SHOWING VARIATION IN WATTAGE

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Because of the impossibility of producing an absolute vacuum and with a view to reducing if possible the evaporization of the filament, the action of various gases on the filament and their influence on the blackening of the bulb have long been the subject of investigation. Early in Edison's experiments it was suggested to fill the lamps with a chemically inert gas such as nitrogen. However, this introduces the difficulty of the convection of heat from the filament through the gas to the bulb and surrounding air which would involve a loss in efficiency inasmuch as the filament would have to be heated to a correspondingly higher temperature. Fortunately the loss by convection increases in only about the $\frac{1}{3}$ power of the temperature while the radiated energy increases with the $\frac{4}{7}$ power for tungsten. In addition it was found that the cooling action of the gases has a greater influence on thin wires than on comparatively thick ones. A gas pressure of about two-thirds of an atmosphere has been found most suitable.

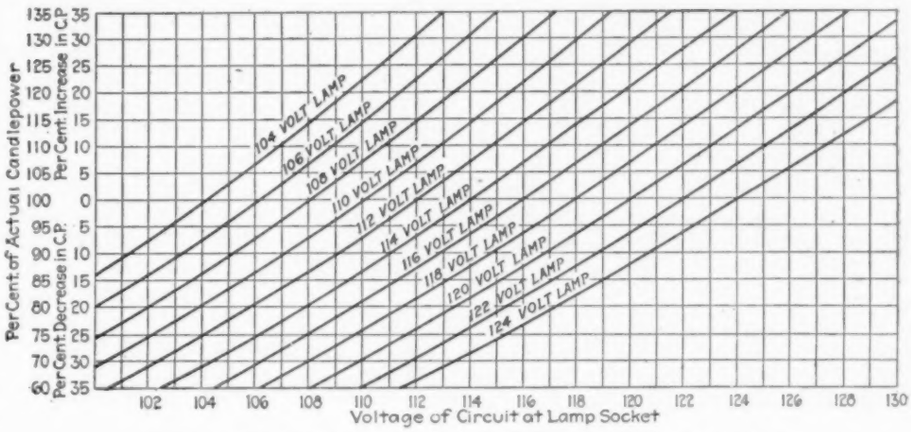


FIG. 30. CHART SHOWING VARIATION IN CANDLE POWER

With the gas-filled lamp the pear-shaped bulb, Fig. 27, has become customary instead of the straight-sided shape, Fig. 28. The reasons for this new shape are that in winding the filament in the form of helical coils the exposed area is reduced, permitting thereby a smaller bulb, and the higher operating temperature necessitates a longer neck of the bulb for cooling the gases before they reach the socket.

During the process of manufacture and after completing the lamps a number of tests are made as a check on the quality of the product. Considerable difficulty was experienced in obtaining a uniform product, particularly before the advent of the present type of lamps. The modern tungsten lamp with a coiled filament of long length or comparatively large cross-section of wire fortunately affords somewhat easier working conditions. The difficulty was principally in making a filament or the individual hairpin-shaped parts of the original tungsten lamp of uniform resistance which would result in lamps of exactly predetermined voltage, amperage and candlepower.

A check on the vacuum of nongas-filled lamps is made by using a Tesla transformer. If a light-green light is emitted from the bulb the vacuum is not good; light-blue light indicates a poor vacuum, and purple still poorer, while a good vacuum is demonstrated by the lamps remaining dark.

The lamps then pass to the photometer room, where they are measured for their proper voltage and labeled accordingly. In the photometer test the light intensity is measured by comparison with a standard lamp and the current changed until a certain number of watts per candlepower is reached.

After photometering, the lamps are ready for basing. The parts of the base are placed in a mold filled with plaster of paris, the lamp then put in and allowed to stand until the plaster hardens. After basing, soldering cleaning and labeling, each lamp is subjected to a

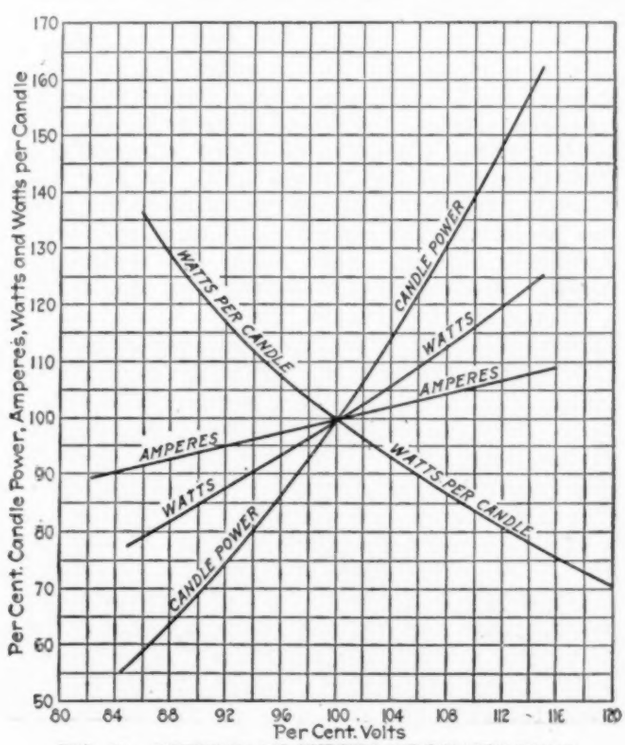


FIG. 32. EFFICIENCY CURVES OF DRAWN-WIRE TUNGSTEN LAMP

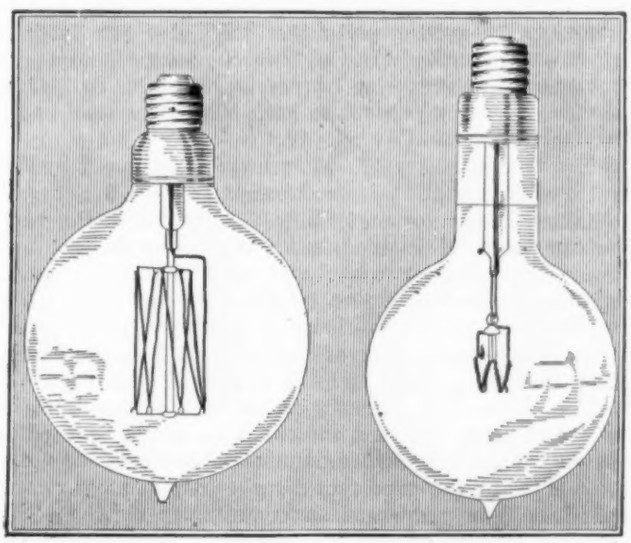
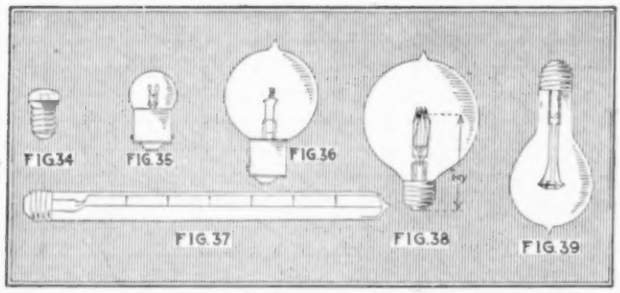


FIG. 33. RELATIVE SIZES OF A 500-WATT VACUUM LAMP (LEFT) AND A 1000-WATT NITROGEN LAMP (RIGHT)



FIGS. 34 TO 39. TYPES OF INCANDESCENT LAMPS
Fig. 34—Flashlight lamp. Fig. 35—Lamp for lighting speedometer. Fig. 36—Lamp for headlight or spotlight. Fig. 37—Lamp for lighting signs. Fig. 38—Lamp for locomotive headlight. Fig. 39—Lamp for train lighting.

final inspection for mechanical defects and is lighted up to insure that no bad lamps are shipped. In order to keep a check on the factories the engineering department of the various manufacturers test a certain percentage of all lamps made for life performance. Elaborate equipment is necessary for this, and in these life tests the lamps are of course destroyed. Huge sums of money are expended yearly for energy to burn lamps and every means taken to insure fair and accurate testing. One of the lamp-manufacturing companies in this country has in such life tests destroyed as many as 50,000 lamps to know what each method of production or each new type developed will actually do.

At one of the large lamp factories lamps are turned out at the rate of over 300 a minute every working day in the year, but accuracies are maintained hardly equaled in any other industry. The bulbs must average a specified thickness from which they may not vary 0.006 in.; the filament may not vary from a definite diameter in any particular lamp more than 0.00001 in.; the glass tubing must not vary in diameter more than 0.45 mm.; the basing cement is prepared according to a chemical formula and must not vary from fixed proportions. All lamps are made up in accordance with standard specifications. The rating of each lamp sold is decided upon only after a careful investigation of the many different factors involved. Accuracy, uniformity, attention to details in raw or finished products mean quality.

In spite of the involved processes of making filaments and of finishing the lamps their manufacture has been developed to such a point that they give satisfactory service even in the hands of the most inexperienced and furthermore their price has decreased from that of a costly laboratory product to such a low figure as to be within the reach of everybody.

The true efficiency of a lamp may be measured by the ratio of energy put into it as compared with the energy obtained in the form of light. This ratio in the best vacuum type of incandescent lamp probably does not exceed 4 to 5 per cent., and with the most recent gas-filled lamps not more than 8 or 9 per cent. The reason for this low efficiency is explained by the fact that only a small part of the total of light and heat rays emitted by the lamp lie in the visible spectrum.

The commercial efficiency is the ratio of the input in watts to light obtained measured in terms of candlepower. The early carbon-filament lamp consumed from 7 to 10 watts per candlepower, whereas the most recent gas-filled lamps operate at ½ watt per candle. The gradual rise in efficiency is shown in condensed form in the accompanying table.

However, it should not be understood that because an incandescent lamp is rated at a certain efficiency by the manufacturers this rating would hold regardless of conditions under which the lamp operates. The rated performance; that is, candlepower, watts, life, etc., holds good only when operated at the "labeled" voltage.

Frequently lamps are labeled with three voltages in steps of two volts apart, for example, 110, 108 and 106 volts. Such lamps are rated to give approximately 1000 hours of useful life when operated at high efficiency, 1300 hours at medium efficiency, and at low efficiency 1700 hours. It has been definitely established as the best practice to operate lamps at high efficiency, corresponding to the first figure given for voltage on the label, and having it well understood that this refers to the actual voltage applied at the lamp socket. On any given lamp the lower voltage means that less current

ADVANCE IN LAMP EFFICIENCY

Date	Watts per candle	Candles per watt	Type
1879	7.0	0.14	Carbon
1886	4.0	0.25	Carbon
1896	3.1	0.31	Carbon
1905	2.5	0.4	Metallized
1906	2.0	0.5	Tantalum
1907	1.25	0.8	Mazda
1913	1.0	1.0	Mazda (Drawn Wire)
1914	0.5	2.0	Mazda (Inert Gas)

is passing through the filament and that it is not heated to its proper temperature, and there results a far greater decrease in candlepower than the proportion of the decrease in current, since a very slight change in the temperature of metals produces a very great difference in the degree of incandescence. The energy cost for a certain candlepower is less and the renewal cost greater with higher efficiency. The renewal item is the smaller part of the cost of light, as the energy cost is from 10 to 15 times the renewal cost in a 60- or 100-watt lamp.

In the life of a lamp there is a distinction between the total or "burn-out" life, which refers to the number of hours the lamp will burn before the filament fails completely, and the useful life, which is defined as the number of hours a lamp may be burned before its candlepower has depreciated 20 per cent. At this point, chosen conventionally, although the filament of the lamp may be intact, it is customary to consider the lamp subject to renewal. Such lamps are consuming a wattage very nearly as high as when new but the

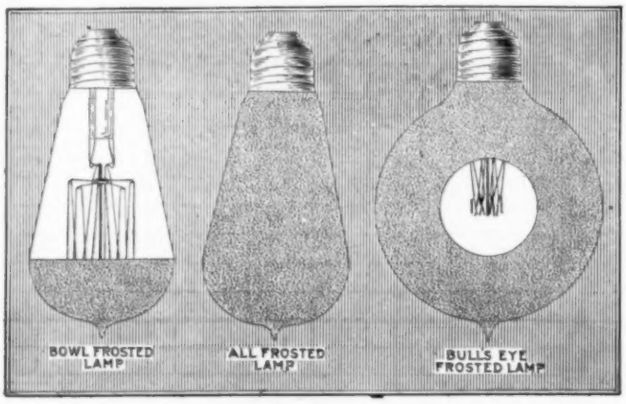


FIG. 40. FROSTED LAMPS

candlepower has fallen off and the efficiency is therefore poor.

How the candlepower and wattage of a lamp vary with the voltage applied at the socket is shown in Figs. 29 and 30. The relation between cost of energy plus cost of renewal for different efficiencies in watts per candle is shown in Fig. 31, and a set of typical characteristic curves for a modern drawn-wire tungsten lamp in given in Fig. 32, indicating the relation between candlepower, amperes, watts or watts per candle and voltage.

Quality and Color of Light

The higher the temperature at which a filament operates or the higher the degree of incandescence the nearer the violet end of the spectrum is the light emitted. In regard to the color of light there has been a steady advance and gradual approach to daylight effect, beginning with the old carbon lamp, where the ratio of blue to green rays was around 45 per cent., through the metallized filament lamp and the vacuum type of tungsten lamp up to the present ½-watt gas-filled lamps in which the ratio is over 60 per cent. and approaches daylight quite closely.

Color-absorbing materials in the bulb of the lamp are employed where it is desired to obtain a particularly close approach to daylight or other effects. This is done either by superficially coloring the bulbs or, better, by the use of so-called natural-colored lamps in which the glass mass itself is made of a composition suitable for filtering out certain shades of rays as may be required for the individual application, such as in paint shops, lithographing plants, wall-paper stores or for the warmer tints of the home.

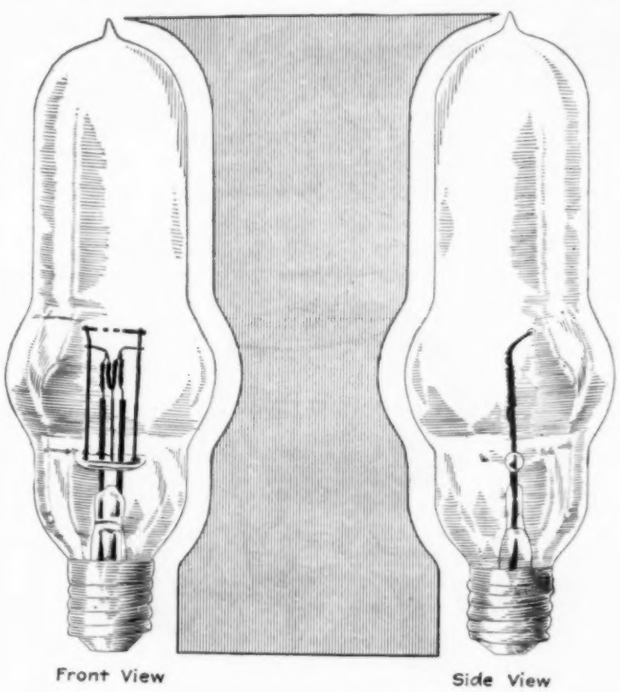


FIG. 41. LAMP FOR MOTION-PICTURE PROJECTION

Simultaneously with the rapid increase in efficiency and the approach to daylight conditions there has been an increase in the capacity of incandescent lamps beyond anything dreamt of. From a candlepower capacity of 150 the range has gradually been extended to over 2000 candlepower, while, as shown in the comparison, Fig. 33, the gas-filled coiled filament lamps can be made smaller than those of the vacuum type of much less capacity.

Incandescent lamps are now made for voltages from ½ to 260 and for all kinds of frequencies, and rugged enough for train-lighting or automobile service. It is not proposed to enumerate the multitude of modifications of incandescent lamps manufactured today for different classes of service, but a few examples are shown in Figs. 34 to 39 to indicate the range of sizes and service. In addition to these the frosted lamp may be mentioned, in which the bulb is treated in acid to give the effect shown in Fig. 40, reducing the glare of the light, or as shown by the bulb with a small round space left clear for special service such as stereopticon use, etc. For the moving-picture industry the drawn-wire type tungsten lamp is now used almost exclusively in place of the arc lamp, and special lamps have been developed for this work, Fig. 41.

Using Two Tools at Once

By Charles Canec

Referring to the article on the subject of using two tools at once which appeared on page 731 of *American Machinist*, let us analyze the problem: It is desired to use two tools instead of one, one tool roughing the work, the other finishing it—all at one setting.

Mr. Jacker mentions the greatest objection; namely, that the unevenness present in the rough material is transferred in lesser degree to the finished work. This prohibits the two-tool scheme in accurate work unless the material is quite round and centered true beforehand.

But suppose the shaft, instead of being all of the same size, is to be made with several diameters, then when we pull out the roughing tool to cut a larger diameter, out comes the finishing tool with it, leaving 3 in. or so of unfinished shaft in its wake which we must turn back to finish afterward. This prohibits the two-tool scheme when there are shoulders on the work.

Considering these disadvantages there is not much work left on which the scheme is practicable.

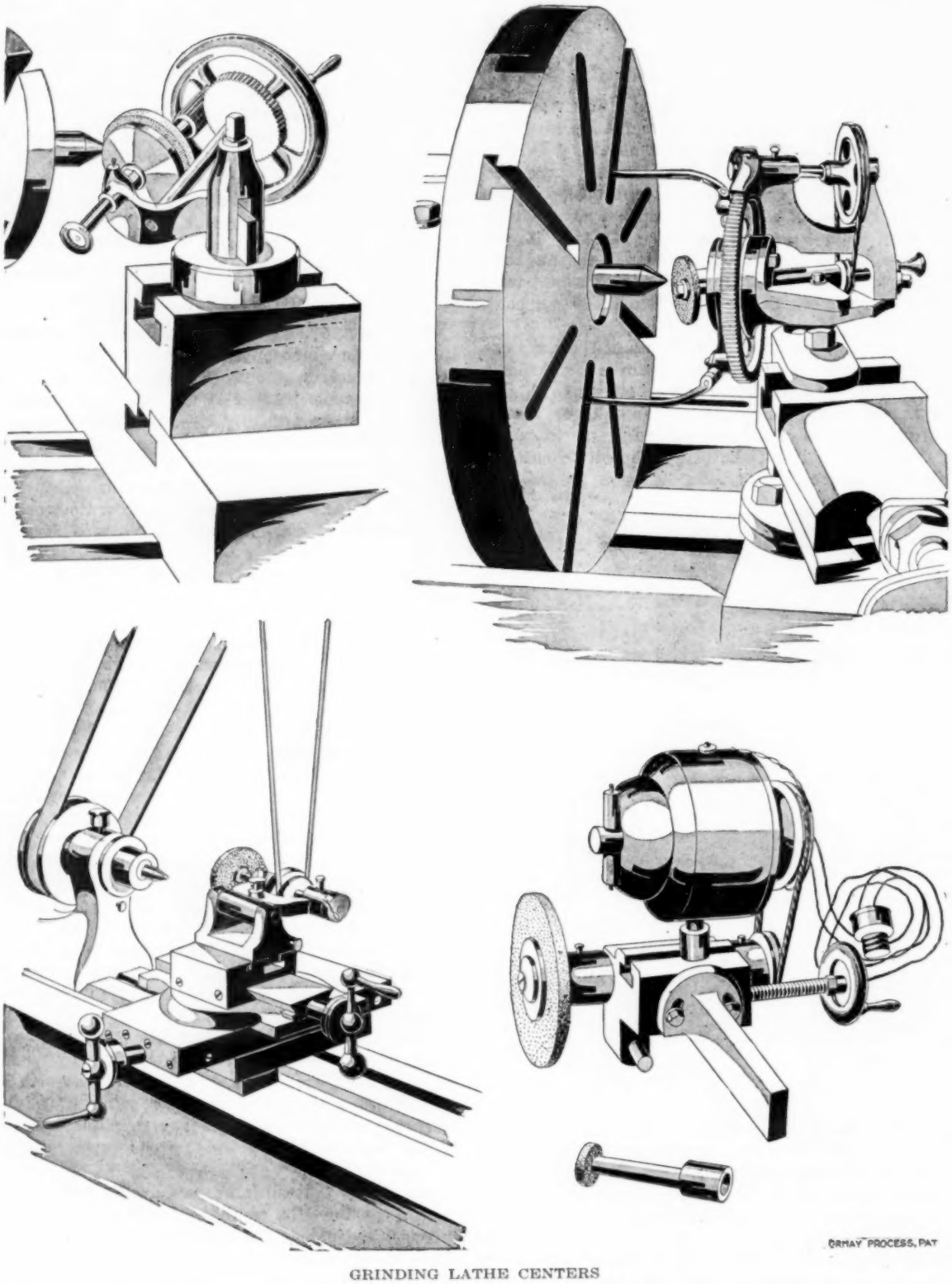
The idea of setting the tools at an angle slanting away from the direction of travel makes it impossible to work close up to the driving dog, and also increases the errors due to bulges and unevenness on the rough material. To slope the tools the other way enables them to cut close up to the dog, while bulges, etc., tend to press them more into the work and in a measure counteract the spring of the machine parts. An offset tool or toolholder is the best thing to use in this position and it so seldom moves in the toolpost that this point is hardly worth considering.

The best practice on shaft work is as follows: Face ends; center; rough-turn diameters $\frac{1}{64}$ to $\frac{1}{32}$ in. over finished dimensions; square off all shoulders to lengths required, at the same time grooving in slightly at corners to make clearance for grinding wheel; then finish by grinding. This produces accurate, well-finished work.

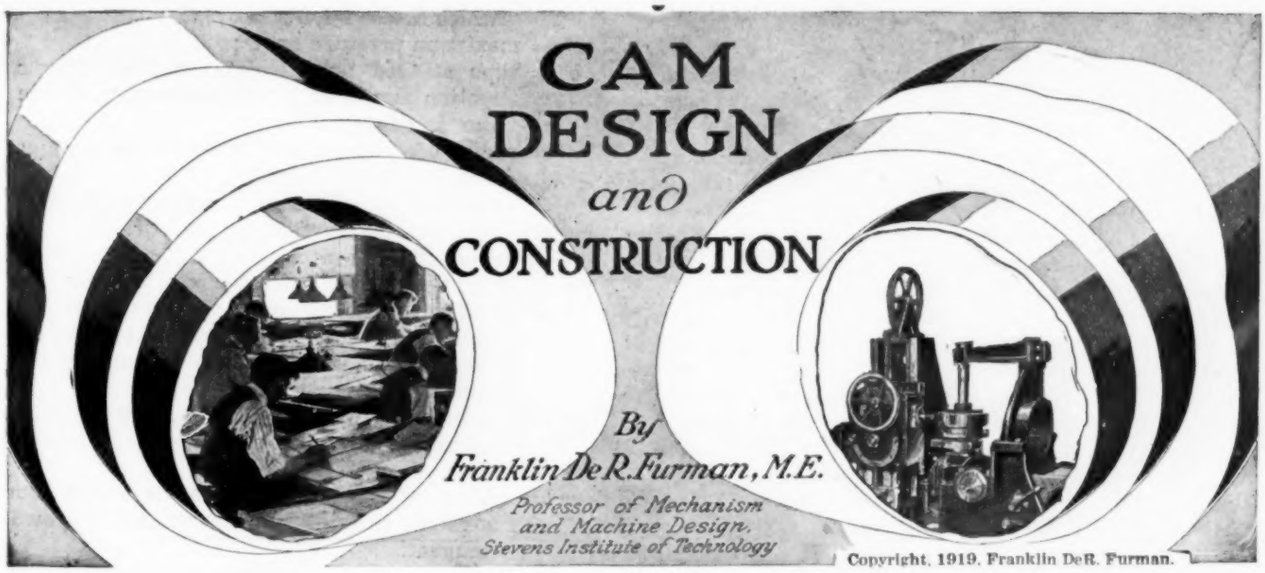
One point that all lathe men should pay attention to is to keep the gibs on the carriage and compound rest properly adjusted; for when these become slack there is too much pressure put on the screws and nuts while cutting, and the lathe cannot be depended on to hold a cut, especially on rough material.

FOR SMALL SHOPS *and* ALL SHOPS

By J. A. Lucas



GRINDING LATHE CENTERS



VIII. The Tangential Cam.

The current article deals first with the cam having straight instead of curved sides, pointing out special difficulties met with in this type of cam; second, with the cam the base curve of which is made up entirely of arcs of circles; third, with the cube-curve cam, which is closely related in methods of construction to the well-known parabola cam, and fourth, with variations of the above types designed to give low starting or striking velocities.

THE TANGENTIAL CAM.—The tangential cam with its straight sides is perhaps the easiest of all cams to draw and to construct when one is not particular about the maximum-pressure angle, but it is apt to give the highest velocities and the greatest accelerations of all the cams when it is laid out by an inexperienced hand. To keep the tangential cam under

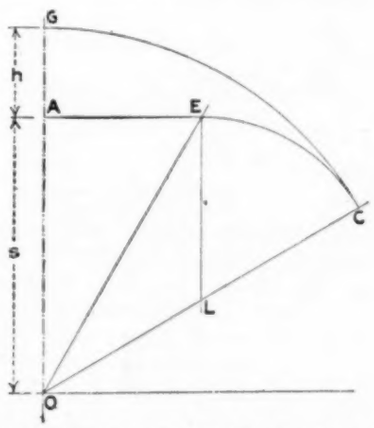


FIG. 70. TANGENTIAL CAM, PRELIMINARY SKETCH IN GRAPHICAL METHOD OF CONSTRUCTION FOR DEFINITELY ASSIGNED DATA

control when being designed requires either a preliminary graphical construction or a series of computations by means of formulas which will give results that may be laid out directly.

Problem 18. Tangential cam, case 1, required a tangential cam in which the follower (a) rises 1 unit in a 60-deg. turn of the cam; (b) falls 1 unit in a 60-deg. turn of the cam; (c) remains at rest for a

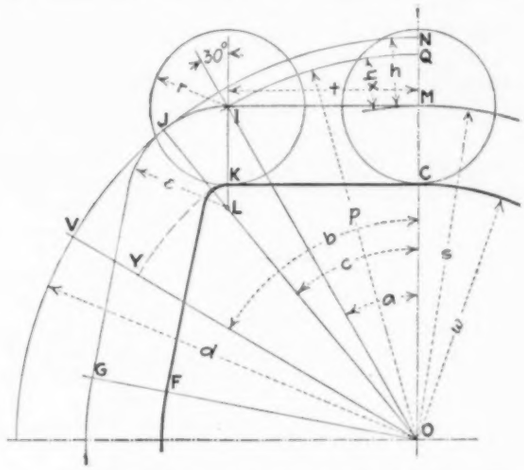


FIG. 71. TANGENTIAL CAM, SHOWING TERMS USED IN THE DIRECT CONSTRUCTION BY THE ANALYTICAL METHOD

240-deg. turn of the cam, and (d) with a maximum pressure angle of 30 deg., the end of the lobe to be rounded off by a circular arc.

Find the shortest radius of pitch surface of cam, the length of the straight-line portion of the cam lobe, the radius of the rounding-off curve at the end and the largest roller that may be used.

The graphical method of construction for the tangential cam is as follows: In a preliminary and separate drawing construct an angle *AOE*, Fig. 70, equal to the given pressure angle; draw a line *AE* at right angles to *OA* at any distance out, and continue *AE* until it intersects *OE;* draw an angle *AOC* equal to the assigned angle of action; drop a vertical line from *E* to *OC;* draw the arc *EC* with *L* as a center; draw the arc *CG* with *O* as a center, and measure the distances *GA* and *AO*. Then $GA : h :: AO : s$ where h is the assigned motion of the follower, and s is the correct radius at which to draw the line *AE* in the direct drawing of the cam. In the present illustration *GA*, Fig. 70, is

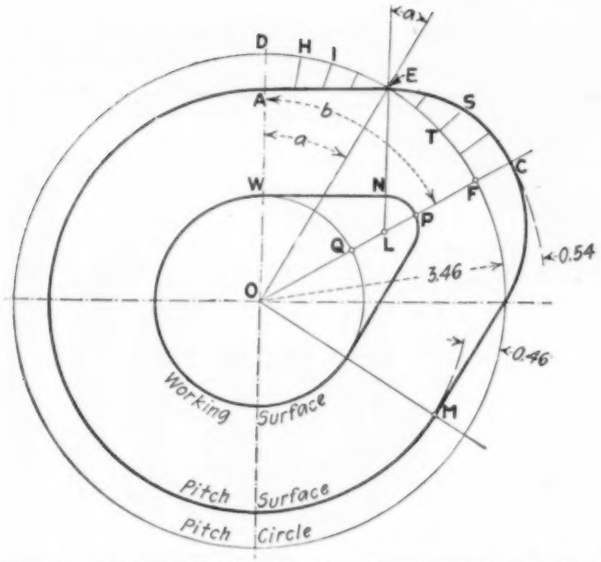


FIG. 72. CAM WITH TANGENTIAL BASE CURVE, CASE 1

1.33 units and AO is 4 units. Therefore in the direct drawing of the cam

$$s = \frac{h \times AO}{GA} = \frac{1 \times 4}{1.33} = 3.00,$$

and this value is laid off at OA, Fig. 72. The pitch surface of the cam AEC is then drawn by repeating the operations in precisely the same order as in the preliminary drawing described above. The maximum pressure angle will be 30 deg. at E where the circular easing-off arc is tangent to the straight line. The maximum radius of the roller would be EL, but as this would leave a sharp edge on the working surface of the cam a value of $\frac{3}{4}EL$ is taken as the radius, thus giving WNP as the working surface of the cam.

Analytical method of construction of the tangential cam.—A direct drawing of the tangential cam may be made from values obtained from a series of formulas, having the following notation, in which all linear dimensions are in inches and all angular dimensions in degrees unless otherwise specified. All symbols are illustrated in Fig. 71, which is for a general case:

h = total motion of follower;
x = fraction of follower's motion while rolling on the straight surface of the cam, or, in other words, fraction of stroke during which acceleration takes place;
a = maximum pressure angle;
b = time allotted by the data to the follower motion measured in angular motion of the cam in degrees;
s = radius of pitch surface to which the straight line is drawn tangent;
t = length of straight edge of cam on both pitch and working surfaces;
p = radius of pitch circle;
d = largest radius of pitch surface of cam;
c = angle turned through by the cam when the full motion of the follower is reached; c will equal b when the straight part of the cam is not assigned in the data;
e = radius of circular arc for rounding off outer corner of pitch cam;
r = radius of roller;
w = radius of working surface to which the straight working line of the cam is drawn tangent.

When the length of the straight part of the cam is not assigned in the data c and b will be equal. When the length of the straight part is assigned c will figure out differently from b; if it comes less the problem is possible with the assigned data; if more the length of the straight part must be reduced.

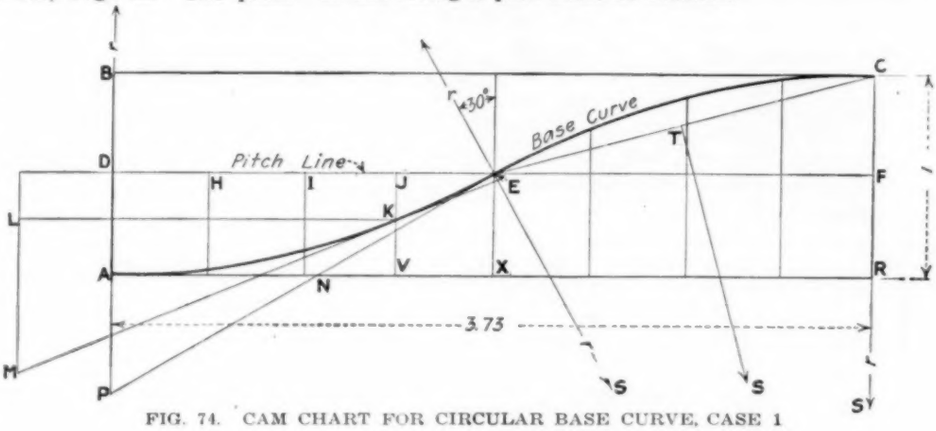


FIG. 74. CAM CHART FOR CIRCULAR BASE CURVE, CASE 1

The general formulas are:

$$s = \frac{xh}{\sec a - 1} \quad (1) \qquad t = s \tan a \quad (2)$$

$$p = \frac{t}{\sin a} \quad (3) \qquad d = s + h \quad (4)$$

$$\cot c = \tfrac{1}{2}\left(\frac{t}{h} - \frac{h}{t}\right) \quad (5) \qquad e = d - \frac{t}{\sin c} \quad (6)$$

$$r \leqq e \quad (7) \qquad w = s - r \quad (8)$$

With the data of the present problem equation 5 must be solved first, for it is the only one in which all the terms but one are known. This formula is solved for t. With t known, formula 2 may be solved for s; then formula 1 for x, and so on in order with equations 3, 4, 6, 7 and 8. These formulas give the following values in the present problem:

$t = 1.73$ $s = 3$ $x = 0.46$ $p = 3.46$
$d = 4$ $e = 2$ $r \leqq 1.5$ $w = 1.5$

With the above values the cam in Fig. 72 is laid out in the following manner: Lay off given angle of 60 deg. at DOC; draw circle, having

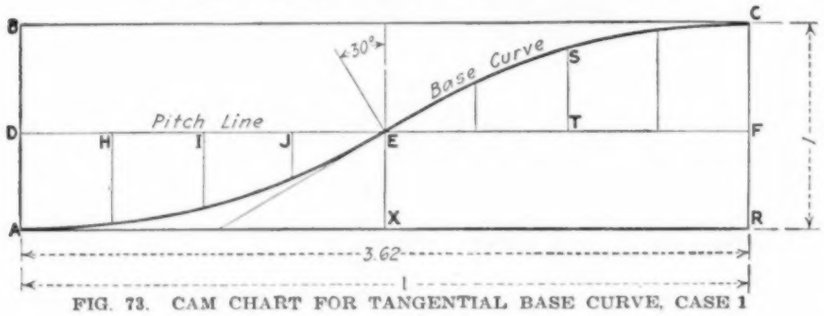


FIG. 73. CAM CHART FOR TANGENTIAL BASE CURVE, CASE 1

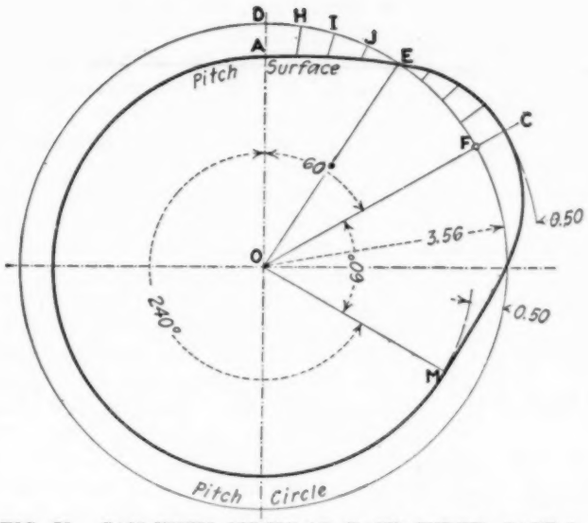


FIG. 75. CAM WITH CIRCULAR BASE CURVE, CASE 1

radius OA equal to s; draw straight part of cam AE equal to t; draw circular arc EC with center on OC and with radius of LC equal to e; call $r = 0.75e$ and make AW equal to it. Then WNP is the working surface of the cam where AW is the radius of the roller. The length WN of the straight part of the working surface is the same as the length of the straight part of the pitch surface and the circular arc of the pitch surface, and the circular arc NP of the working surface has the same center as the arc EC of the pitch surface. The values d and w are automatically included in the process of the above-described layout.

If it is desired to construct the cam chart, Fig. 73, for the tangential cam in order to find the velocity and acceleration diagrams the pitch circle of the cam

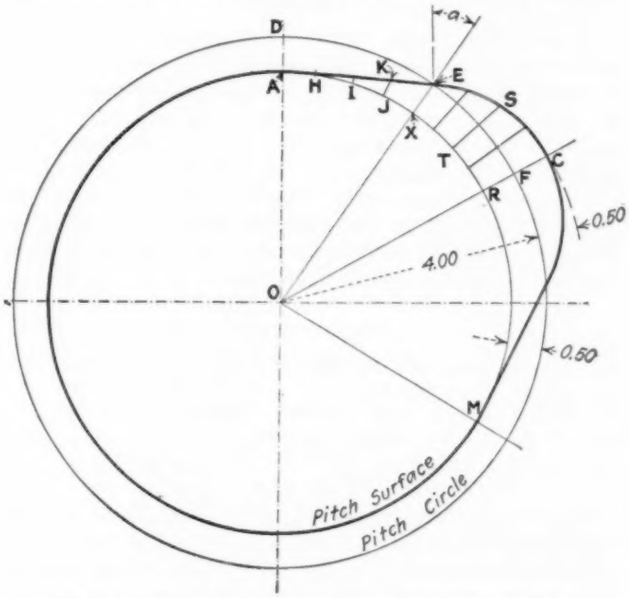


FIG. 77. CAM WITH CUBE BASE CURVE, CASE 1

should be drawn with the radius equal to OE as computed above, and radial intercepts should be placed at regular distances, as shown at H, I, etc., in Fig. 72. Then draw the part of the cam chart, shown in Fig. 73, with length equal to pitch arc DF, when both are to the same scale and with height equal to h. Draw pitch line DF on the chart at a distance above AR equal to DA on the cam when both are to the same scale. In general the pitch line on the chart will not be half way up, although it appears so in this problem. Take the lengths of the radial lines at H, I, etc., which are shown on the cam, and lay them off at equally spaced distances on the chart, Fig. 73, and draw the chart base curve AEC through the extremities of these lines.

Circular curve cam.—The circular base curve, case 1, Fig. 74, is made up simply of two equal circular arcs, as shown at AE and EC. It is the limiting case of the straight-line combination curve in which the two easing-off arcs are so large as to meet and eliminate the intermediate straight line entirely. With the circular base curve the radial distances on the cam at D, H, I, J, Fig. 75, cannot be found directly except by means of the cam chart or by computation. For graphical construction it is necessary to draw the chart, Fig. 74, first and it is then a simple matter to trans-

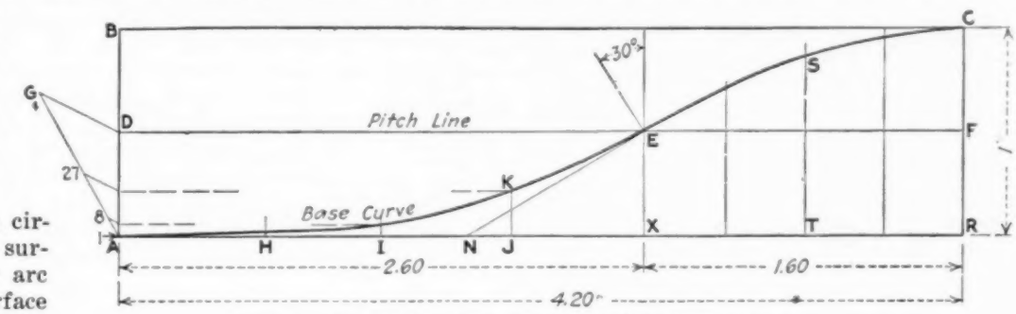


FIG. 76. CAM CHART FOR CUBE BASE CURVE, CASE 1

fer the ordinates at H, I, J to Fig. 75. The length of the chart for a maximum pressure angle of 30 deg. is 3.73 times the motion of the follower.

The length of radius for the equal arcs in the circular base curve is 3.73 times the follower motion for a 30-deg. maximum pressure angle. To find the length of radius for any other maximum pressure angle, use the formula:

$$r = \frac{h}{2(1 - \cos a)}$$

where r = the desired radius;
a = the desired maximum pressure angle, and
h = the given follower motion.

TABLE FOR CIRCULAR BASE CURVE

For Maximum Pressure Angle of	Radius of Arc Is
20 deg.	8.29 h
30 deg.	3.73 h
40 deg.	2.14 h
50 deg.	1.40 h
60 deg.	1.00 h

Problem 19. Required a circular base curve cam that will cause the follower to (a) rise 1 unit in a 60-deg. turn of cam; (b) fall 1 unit in a 60-deg. turn of cam; (c) remain stationary for a 240-deg. turn of cam, and (d) with a maximum pressure angle of 30 degrees.

The general description of the circular base curve given in the preceding paragraphs will doubtless give all the necessary information for the solution of this

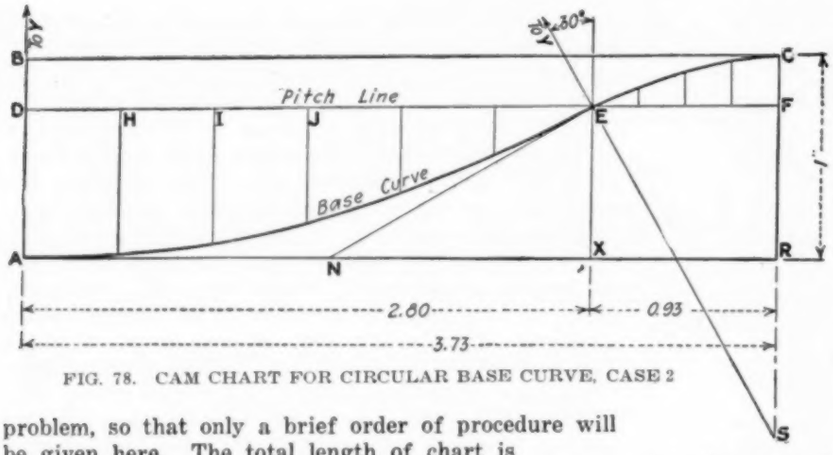


FIG. 78. CAM CHART FOR CIRCULAR BASE CURVE, CASE 2

problem, so that only a brief order of procedure will be given here. The total length of chart is

$$l \times 3.73 \times \frac{360}{60} = 22.38$$

One-sixth of this length is shown in Fig. 74. The radius of the circular arc AE, which is the same as EC, is

$$r = \frac{1}{2(1 - \cos a)} = \frac{1}{2(1 - 0.866)} = 3.73$$

of action DF, which is 60 deg., into eight equal parts, as at H, I, J, etc. On the radial lines at each of these points lay off the corresponding ordinates from H, I, J, etc., in the chart, Fig. 74, thus obtaining the pitch surface AEC, Fig. 75.

In some cases it may happen when the circular base curve is assigned that the length and height only of the rectangular chart inclosing the circular curve will be known, and it may be desired to compute the radius, and the pressure angle for the circular arc that must be used. For example, in Fig. 74, assume that AR and RC are the only known values and it is desired to find the proper radius of the arc EC and the pressure angle that will exist at E. The radius may be readily computed by simple geometry, for the two triangles CFE and CTS will be similar in all cases and therefore $SC : EC :: TC : FC$. Since EF and FC are equal to one-half of AR and RC respectively their values are

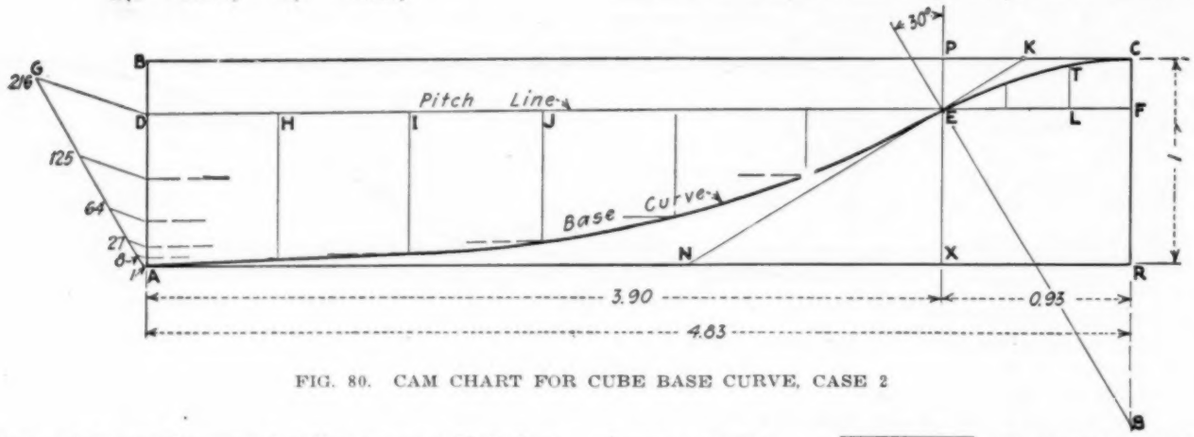


FIG. 80. CAM CHART FOR CUBE BASE CURVE, CASE 2

Draw eight equally spaced ordinates as at H, I, J, etc., Fig. 74. The radius of the pitch circle of the cam, which is drawn to one-third the scale of the chart, is

$$\frac{22.38}{2 \times 3.14} = 3.56,$$

as shown at OD in Fig. 75. Divide the assigned arc

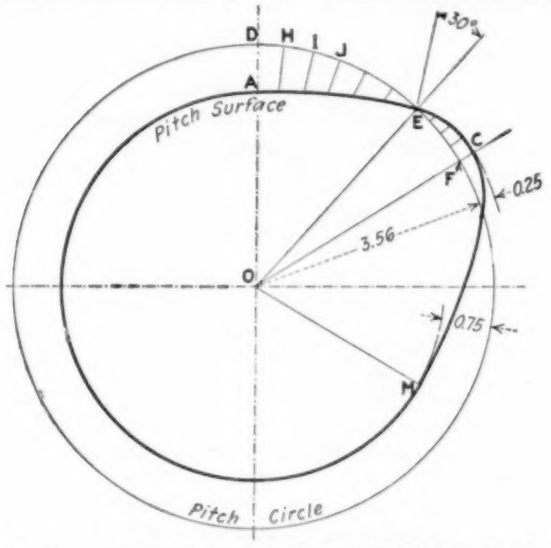


FIG. 79. CAM WITH CIRCULAR BASE CURVE, CASE 2

known and $EC = \sqrt{EF^2 + FC^2}$. The length of TC is one-half of EC.

The radius of the circular arc will be

$$SC = \frac{EC \times TC}{FC}$$

In order to obtain the pressure angle for the case given in the preceding paragraph simple trigonometry is required, and in using the trigonometry the length of the radius SC may also be obtained even more readily than by geometry. The method is as follows: In Fig. 74 the angles CST and EST are each equal to one-half the angle CSE, which is the pressure angle and is designated by a in the following formulas. The triangles CEF and CST are similar in all cases. Therefore a may be found by the following formula:

$$\tan \tfrac{1}{2}a = \frac{CF}{EF}$$

With a known, the radius of the arc EC may also be found as follows:

$$ES = \frac{EF}{\sin a} = CS$$

CUBE CAM

Cube base curve, symmetrically applied.—The cube base curve is similar in method of construction to the parabola base curve, the only difference being that the cubes of the numbers 1, 2, 3, etc., instead of the squares

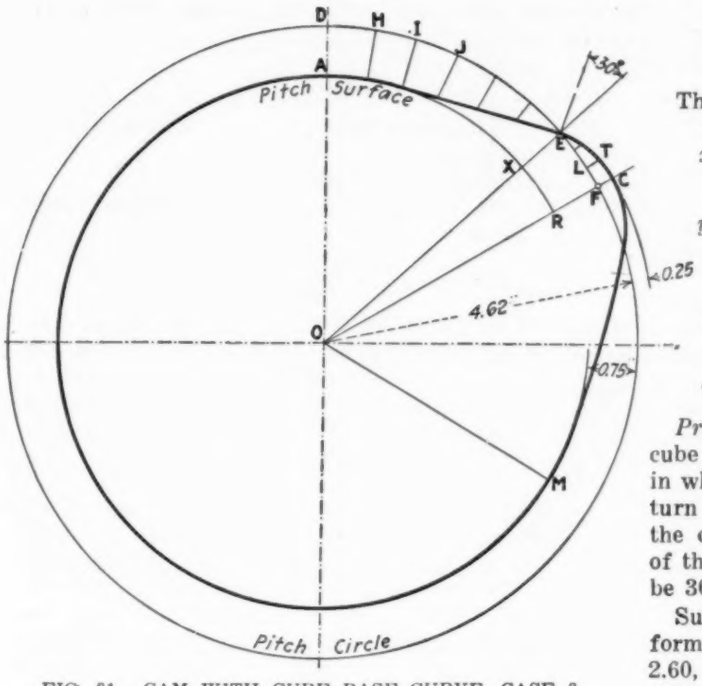


FIG. 81. CAM WITH CUBE BASE CURVE, CASE 2

are used as ordinates of the curve. The cube curve gives extremely low and slowly increasing motion to the follower at the start. The cube curve is the only one that gives uniformly increasing acceleration to the follower, which may prove an advantage in some instances, as will be pointed out in the next installment. If the cube base curve is used in the same way as the parabola; that is, if it is made up of two similar arcs placed in reverse order, it will give an extremely large cam.

Because of the similarity of method of construction of the cube and the parabola base curves, and because the large size of the symmetrical cube cam renders it impractical for most cases, its drawing will be omitted, and instead a modified and more practical construction of the cube cam will be illustrated and explained in the following paragraphs.

Cube base curve unsymmetrically applied for best advantage.—This modified cube curve will be referred to as cube curve, case 1. Its features are that it retains the very low starting values of the regulation or symmetrical cube cam and at the same time keeps down the size of the cam by using the regulation cube curve for the first half of the follower's motion and then using a short arc of another cube curve for the retardation in such a way that the maximum acceleration and retardation values shall be equal. In order to use this base curve several formulas are necessary, and they together with their notation are given in the following paragraph:

Notation and formulas for cube curve cam, case 1.—

h = distance moved by the follower;
a = pressure angle;
l = length of part of cam chart corresponding to follower's motion;
x = length of cam chart during which acceleration takes place;
x_1, x_2 = arbitrary lengths of cam chart taken for purposes of constructing chart base curve;
y_1, y_2 = length of ordinates of cam chart corresponding to the values of x^1, x^2 . . . ;
r = radius of pitch circle of cam;
b = angle turned through by cam in degrees during follower's motion.

The general formulas are:

$$l = 2.427\, h \cot a \qquad (1)$$

$$x = 0.618\, l \qquad (2)$$

$$y = \frac{h\left(\frac{x}{l}\right)^3}{2\sqrt{5}-4} \text{ from zero to } x \qquad (3)$$

$$y = h\,\frac{3\left(\frac{x}{l}\right)-\left(\frac{x}{l}\right)^3-(\sqrt{5}-1)}{3-\sqrt{5}} \text{ from } x \text{ to } l \qquad (4)$$

$$r = \frac{180\, l}{\pi\, b} \qquad (5)$$

Problem 20, cube curve cam, case 1.—Required a cube curve cam with unsymmetrical cube curve arcs in which the follower shall (a) rise 1 unit in a 60-deg. turn of the cam; (b) fall 1 unit in a 60-deg. turn of the cam; (c) remain stationary for a 240-deg. turn of the cam, and (d) the maximum pressure angle shall be 30 degrees.

Substituting the values given in the data in the formulas in the preceding paragraph, $l = 4.20$, $x = 2.60$, and $r = 4.00$. With these values, the rectangle $ABCR$, Fig. 76, for the cam chart may be drawn, AR being made equal to l, AX equal to x, and RC equal to h. The curve AE may be drawn graphically by dividing AX into four equal parts, AD into four unequal parts, as shown in Fig. 76, and projecting the division points until they meet as at K, AD, which is one-half of AB, is divided into the four unequal parts as follows: Draw a straight line AG in any convenient direction about as shown; make its length 64 units according to any convenient scale; with the scale

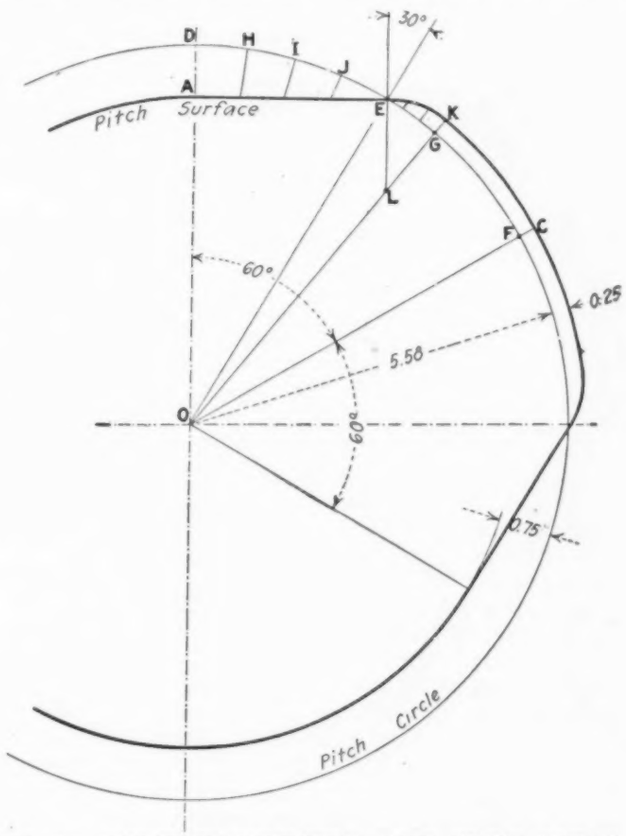


FIG. 82. CAM WITH TANGENTIAL BASE CURVE, CASE 2

still in place mark the first, eighth and twenty-seventh division points on AG, and from each of these points draw lines parallel to GD until they intersect the side AD of the rectangle; from the latter points draw horizontal lines until they intersect their corresponding ordinates, as at K. Or, the values of these ordinates, as at JK, may be computed by formula 3, as given above, by substituting the following values for x: $x^1 = \frac{1}{4}x$, $x_2 = \frac{1}{2}x$, $x_3 = \frac{3}{4}x$. The computed values of y_1, y_2, y_3 are 0.008, 0.063 and 0.211 respectively, and these are laid off at H, I and J in Fig. 76.

The portion of the cube curve from E to C, Fig. 76, is found by taking a series of any number of equally spaced ordinates, four being used in this problem and one of them marked at TS. The values of these ordinates are computed from formula 4 and are as follows: $y_1 = 0.50$, $y_2 = 0.71$, $y_3 = 0.87$ (shown at ST), and $y_4 = 0.95$. The corresponding values of x_1, x_2 ... which were substituted for x in equation 4 in obtaining these values were $x_1 = x$, $x_2 = x + \frac{1}{4}(l - x)$, $x_3 = x + \frac{1}{2}(l - x)$, etc.

The pitch circle of the cam, Problem 20, is drawn with OD, Fig. 77, as a radius and is equal to $r = 4.00$ obtained from equation 5. The values as found for the cam chart may be now transferred to the correspondingly placed radial lines from A to R; or the values as computed from formulas 3 and 4 may be laid off directly on these radial lines without drawing the cam chart at all, thus obtaining the cam outline AEC.

Cams specially designed for low starting velocities.— In cams where the change in velocity of the follower during the latter part of its travel may take place rapidly the early motion of the follower may be made both very low and very gradual. These conditions as to velocity may be obtained by giving more than half the stroke to the acceleration of the follower, instead of one-half, as has been the case in all preceding problems. In Figs. 78 and 80 are illustrated special cases of the circular and cube base curves in which the follower is permitted to accelerate during three-quarters of its stroke, while its retardation takes place in the last quarter of the stroke.

Problem 21. Circular base curve cam, case 2.— Required a cam with a circular base curve in which the follower shall (a) rise 1 unit in a 60-deg. turn of the cam; (b) fall 1 unit in a 60-deg. turn of the cam; (c) remain stationary for a 240-deg. turn of the cam; (d) accelerate for three-quarters of its stroke, and in which (e) the maximum pressure angle shall be 30 deg.

For a graphical method of construction of case 2 of the circular base curve cam draw the cam chart as in Fig. 78, making its length

$$l = \frac{h \times f \times 360}{b}, \text{ where}$$

l = total length of chart;
h = height of chart;
f = pressure angle factor;
b = angle during which follower motion takes place.

In this problem $l = \frac{1 \times 3.73 \times 360}{60} = 22.38$

One-sixth of the chart is shown in Fig. 78, at AR. Lay off the height AB equal to one unit and mark the point D so that $AD = t$ where t equals fraction of stroke assigned for acceleration. Draw DF. Mark the point X on AR so that $AX = t \times AR$. Draw XE. Through E draw an inclined line making an angle with XE equal to the assigned pressure angle. Where this inclined line meets the lines AB and CR will be the centers for the circular arcs making up the base curve. These center points will be at Y and at S

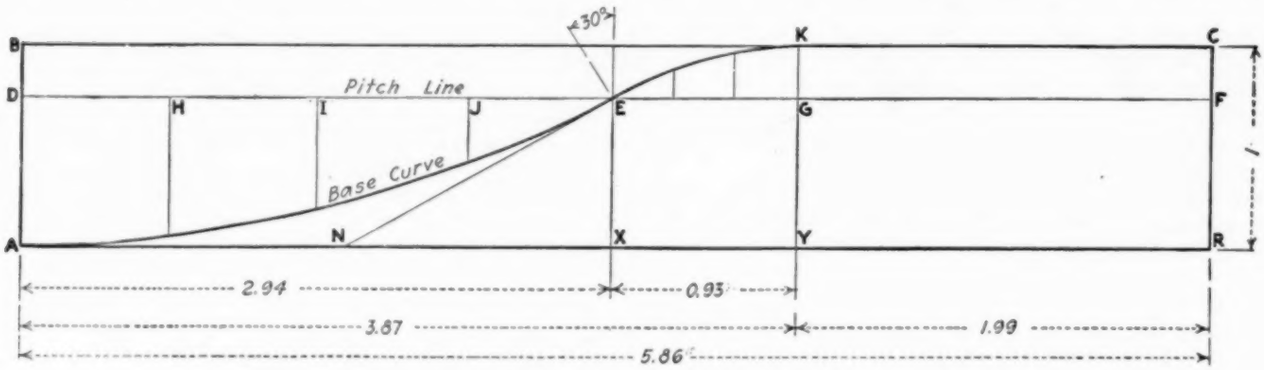


FIG. 83. CAM CHART FOR TANGENTIAL BASE CURVE, CASE 2

respectively. Draw the circular arcs AE and EC. Divide DE into a convenient number of equal parts, as at H, I ... and draw ordinates to the circular arc AE. Do the same with EF. Construct the pitch circle of the cam with a radius,

$$OD = \frac{l}{2 \times 3.14} = \frac{22.38}{6.28} = 3.56$$

as shown in Fig. 79 which is drawn to one-third the scale of Fig. 78. Lay off DOF equal to the assigned motion angle, which is 60 deg. in this problem. The arc DF will be equal in length to the line DF in the chart when both are drawn to the same scale. Make DE on the arc equal to DE on the chart and divide the arc DE into the same number of equal parts as the line DE. Draw radial lines at the division points H, I, J ... and transfer the ordinates from the chart to these radial lines, thus obtaining the pitch surface of the cam from A to E. Do likewise to obtain the arc EC of the cam.

The circular base curve, case 2, gives a smaller cam than does case 1, although both have the same pressure angle factor and the same chart length. The maximum radius of the cam for case 2 is 3.81 against 4.06 for case 1, as shown in Figs. 79 and 75 respectively. The reduction in size in case 2 is due to the fact that the pitch line DF on the cam chart is higher up in the present case and consequently that more of the pitch surface falls inside of the pitch circle than in Fig. 75. The pitch circle is the same size in both cases.

Method for computing circular base curve.—Computation for the lengths of the radii for the arcs *AE* and *EC* in the cam chart in Fig. 78 may be made by the following formulas, if desired, instead of finding them graphically as described above:

$$AY = \frac{ht}{1 - \cos a}, \text{ and } CS = \frac{h(1-t)}{1-\cos a}$$

where a equals the assigned pressure angle, h equals follower motion and t equals fraction of stroke assigned to acceleration.

The use of the cube curve for obtaining extremely low starting velocities is illustrated in Figs. 80 and 81. The cam is built up from a specially long arc of the cube base curve and it has a short circular base arc for easing off at the end. The chart and the base curve for this cam are shown in Fig. 80. The low starting velocities are due to the fact that the follower has three-quarters of its stroke to reach maximum velocity. This gives only ¼ stroke for retardation, which attains a very high value near the end of the stroke.

Problem 22. Cube curve, case 2.—Required a cube curve cam with a circular arc for easing-off radius in which the follower (a) rises 1 unit in a 60-deg. turn of the cam; (b) falls 1 unit in a 60-deg. turn of the cam; (c) remains stationary for a 240-deg. turn of the cam; (d) accelerates during three-quarters of the stroke, and (e) the maximum pressure angle to be 30 degrees.

In solving the above problem the length *AX*, Fig. 80, of that part of the chart which is given over to the cube curve is first found by the formula,

$$x_1 = \frac{3th}{\tan a}, \text{ where}$$

t = the fractional part of the follower's motion devoted to acceleration;
h = the total motion of the follower;
a = the pressure angle;
x_1 = the length of chart under the cube curve;
x_2 = the length of chart under the circular easing-off arc.

Substituting the values given in problem 22

$$x_1 = \frac{3 \times 0.75 \times 1}{0.577} = 3.90$$

The length *XR* of chart, Fig. 80, necessary for the easing-off circular arc may be computed by the formula,

$$x_2 = \frac{h(1-t)}{\tan 1/2\, a} = \frac{0.25}{0.268} = 0.93$$

Or the length *XR* may be found directly by drawing *NEK* so that it is tangent to the cube curve at *E*. The angle *KEF* will then be equal to the pressure angle. Make *KC* equal to *EK*. The point *C* will then be at the end of the chart. The center for the arc *EC* will be on the line *CR* extended, and at a point *S* which must also be on the perpendicular to *NEK*.

To find points on the cube base curve *AE*, Fig. 80, divide *DE* into any convenient number of equal parts, six being used in the illustration. Draw vertical lines through each of the division points as at *H*, *I*, ... Draw a line *AG* inclining upward from *A* in any convenient direction, and make the distance *AG* equal to the cube of the number of construction parts. Six parts having been chosen in this problem *AG* will be equal to the cube of 6, or 216 units in length, laid off to any convenient scale. At the same time lay off the division points 1, 8, 27, etc., which are the cubes of 1, 2, 3, etc. Draw the line *GD* and then draw lines parallel to it through the points 1, 8, 27, etc., until they intersect *AD*. Project these intersecting points horizontally until they meet the corresponding verticals from *H*, *I*, ..., thus giving points on the cube base curve *AE*.

The radius for the pitch circle of the cam will be

$$r = \frac{l \times 360}{2 \times \pi \times b} = \frac{4.83 \times 360}{6.28 \times 60} = 4.62$$

where l = length of chart used for rise of follower, and
b = angle during which the follower is moving.

With the above value of r the circle through *D* is drawn in Fig. 81. The arc *DEF* will be equal in length to the line *DEF* in Fig. 80 when drawn to the same scale, and it should be similarly divided and the radial lines at *H*, *I*, ..., made equal to the similarly lettered ordinates in the chart. The curve *AEC* thus obtained will be the pitch surface of the cam.

Tangential cam, case 2.—The tangential cam is made up of straight-line sides with a circular arc for rounding off the end of the lobe. When the length of the straight surface of the cam is not specified, or when the portion of the stroke during which the follower accelerates is not given in the data, the tangential type of cam may work out to good advantage. But when either of the above items is included in the data for the tangential cam it may conflict with the proper cam angle which should be allowed for the follower motion, as illustrated in the following problem, which contains the same data as the two previous problems. The possible difficulty met with in using the tangential cam arises from high acceleration that may be produced. The matter of accelerations produced by all types of cams will be considered in the next article.

Problem 23. Tangential cam, case 2.—Required a tangential cam with a circular easing-off arc in which the follower (a) rises 1 unit during a 60-deg. turn of the cam; (b) falls 1 unit during a 60-deg. turn of the cam; (c) remains stationary for a 240-deg. turn of the cam; (d) accelerates during three-quarters of its stroke, and (e) the maximum pressure angle to be 30 degrees.

The cam may be constructed directly by substituting values given in the data in the general formulas given in problem 18, and then laying down the results as in Fig. 82. In the present problem *OA*, Fig. 82, equals s as found in problem 18, $AE = t$, $OD = p$, $OC = d$, angle $DOC = b$, angle $DOK = c$ and $LE = e$. The radius r of the roller and the minimum radius w of the working surface are not shown in the illustration, but may be readily added if called for. The radius of the roller, however, cannot be greater than *EL*. The numerical results found by substituting the values given in the data in the series of formulas referred to above are as follows:

$$s = 4.84,\ t = 2.79,\ p = 5.58,\ d = 5.84,$$
$$c = 39\tfrac{3}{4} \text{ deg.},\ e = 1.47.$$

If it is desired to construct the cam chart for the purpose of determining the velocity and acceleration diagrams later it may readily be done (1) by making the length of chart *AR*, Fig. 83, equal to the length of the arc *DF* on the cam drawing; (2) by laying off the pitch line *DF* on the chart and subdividing the same as the arc *DF* on the cam is subdivided, and (3) by transferring the radial lines at *H*, *I*, ... from the cam to the chart and drawing them as vertical lines, thus obtaining points for the base curve *AEKC*.

The Care of Carburizing Compounds

By W. H. Addis

Of all the opportunities for practicing economy in the heat-treatment department, there is none that offers greater possibilities for profitable returns than the systematic cleaning, blending and reworking of artificial carburizers, or compounds.

The question of whether or not it is practical to take up the work depends upon the nature of the output.

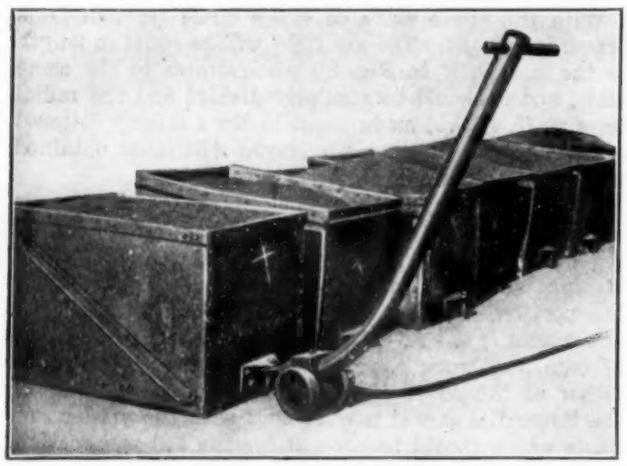


FIG. 1. THE COOLING CARTS

If the sole product of the hardening department consists of a 1.10 carbon case or harder, requiring a strong highly energized material of deep penetrative power such as that used in the carburizing of ball races, hub-bearings and the like, it would be best to dispose of the used material to some concern whose product requires a case with from 0.70 to 0.90 carbon, but where there is a large variety of work the compound may be so handled that there will be practically no waste.

This is accomplished with one of the most widely known artificial carburizers by giving all the compound in the plant three distinct classifications: "New," being direct from the maker; "half and half," being one part of new and one part first run; and "2 to 1," which consists of two parts of old and one part new.

Separating the Work from the Compound

During the pulling of the heat, the pots are dumped upon a cast-iron screen which forms a table or apron for the furnace. Directly beneath this table is located one of the steel conveyor carts, shown in Fig. 1, which is provided with two wheels at the rear and a dolly clevis at the front, which allows it to be hauled away from beneath the furnace apron while filled with red-hot compound. A steel cover is provided for each box, and the material is allowed to cool without losing much of the evolved gases which are still being thrown off by the compound.

As this compound comes from the carburizing pots it contains bits of fireclay which represent a part of the luting used for sealing, and there may be small parts of work or bits of fused material in it as well. After cooling, the compound is very dusty and disagreeable to handle, and, before it can be used again, must be sifted, cleaned and blended.

Some time ago the writer was confronted with this proposition for one of the largest consumers of carburizing compound in the world, and the problem is handled in the following manner: First the cooled compound is dumped from the cooling cars and sprinkled with a low-grade oil which serves the dual purposes of settling the dust and adding a certain percentage of valuable hydrocarbon to the compound. In Fig. 2 is shown the machine that was designed to do the cleaning and blending.

Blending the Compound

Essentially, this consists of the sturdy, power-driven separator and fanning mill which separates the foreign matter from the compound and elevates it into a large settling basin which is formed by the top of the steel housing that incloses the apparatus. After reaching the settling basin, the compound falls by gravity into a power-driven rotary mixing tub which is directly beneath the settling basin. Here the blending is done by mixing the proper amount of various grades of material together. After blending the compound, it is ready to be stored in labeled containers and delivered to the packing room.

It will be seen that by this simple system there is the least possible loss of energy from the compound. The saving commences the moment the cooling cart is covered and preserves the valuable dust which is saved by the oiling and the settling basin of the blending machine.

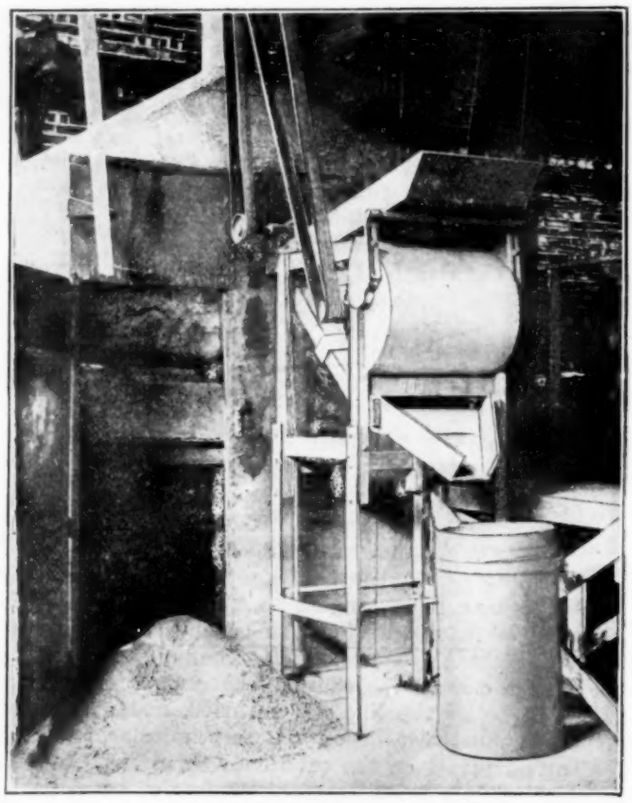


FIG. 2. THE BLENDING MACHINE

Then, too, there is the added convenience of the packers who have a thoroughly cleaned, dustless, and standardized product to work with. Of course, this also tends to insure uniformity in the case-hardening operation.

With this outfit, one man cleans and blends as much compound in one hour as he formerly did in ten.

Machining Operations on Reed Pipe Dies

By J. H. VINCENT

The methods employed in this plant represent the development of efficient methods of producing pipe dies of various grades and for many uses. Many of the machining operations are simply performed but the tooling fixtures are arranged to handle large quantities of parts. The method of casting the solid die is unusual and results in an appreciable saving.

A WIDE variety of pipe dies or chasers is made by the Reed Manufacturing Co., Erie, Penn., to meet all demands of the pipe-fitters' trade. The solid form of die is the simplest, and of these the "Q & E" type is ingenious because it is composed of a body of gray iron cast about high-grade steel chaser-blanks, so that a grade of steel can be used that would add greatly to the cost were the solid die composed of this material.

The bits of steel for these chaser-blanks are sheared from the bar and have several small recesses drilled in their bases to form locking holds for the cast iron. In the foundry a molder sets them in sand molds as if they were cores at an angle with the radius which is designed to give them the same degree of rake on their cutting surface as has been found most efficient in lathe-threading tools.

The first operation on these cast dies is to clean out all the fins of iron which may have formed about the steel blank, and this is done on a standard vertical die-filing machine, Fig. 1. This arrangement permits the operator to have both hands free for rapidly manipulating the parts about the small machine-operated three-cornered file. The second operation is to grind one face of the die to a smooth surface, by holding the casting in the revolving chuck *A*, Fig. 2, mounted on a movable carriage which can be advanced to press it up against the surface-grinding wheel *B*. The blanks are then milled on the opposite face to insure parallel faces of standard thickness. For this operation a large number are placed in a double row in a long horizontal fixture, Fig. 3, mounted on a milling-machine table. The four edges are milled and squared up in a similar way.

FIG. 1. USING DIE-FILING MACHINE FOR REMOVING FINS FROM SOLID CAST DIES

The blanks are taper-reamed to the proper angle and radius by means of special reamers carried on the spindle of a gang-drilling machine, Fig. 4. The fixtures which are used for holding the blanks are graduated for different sizes of dies and there are no two alike under the different spindles of the machine, so that the operator who is running the three spindles will be working on three different sizes of blanks. The chasing of the thread is done on a semi-automatic machine which has been designed for this purpose.

The type of adjustable die known as the "Improved Armstrong" is composed of solid steel parts and the blanks for these are sawed from tool-steel bar stock. As shown in Fig. 5, the large hole for the holding-down bolt *A* and the two small holes *B* which form the end of the chip-clearance recess are drilled in a gang-drilling machine which carries, in its different spindles, the required sizes of drills. The jigs used are shown at *C*. The chip-clearance groove is opened up, and the angles are milled on the ends in a manner which makes the chaser ends of these dies appear to be of unequal length, *A*, Fig. 6, and to set at unequal angles, but this is done just as in the solid dies in order to have the chasers meet their work with an angle of rake. A

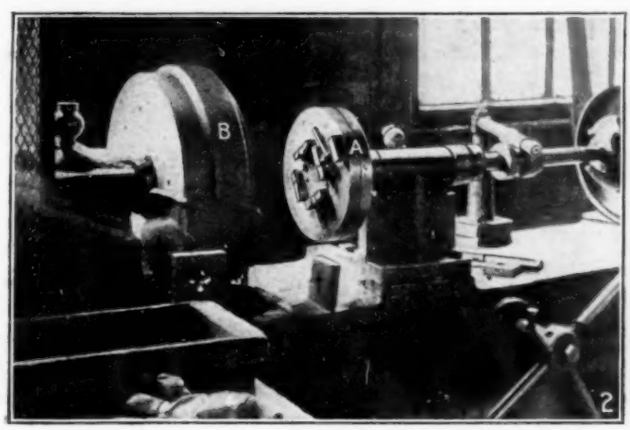


FIG. 2. FINISHING FACE OF SOLID DIES

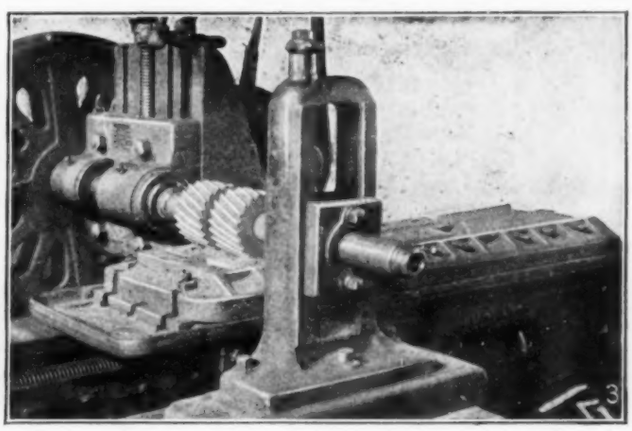


FIG. 3. MILLING DIES TO UNIFORM THICKNESS

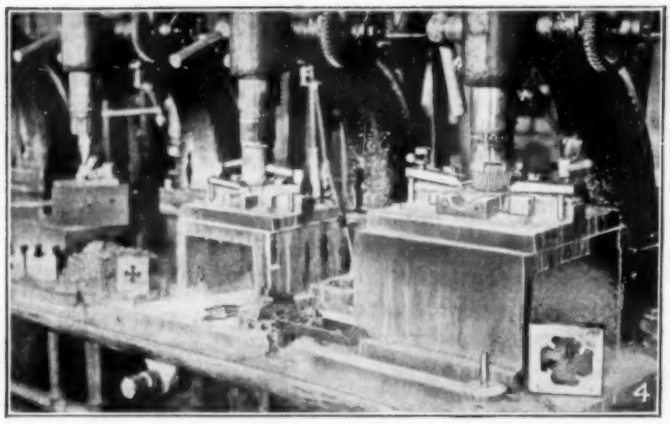


FIG. 4. TAPER-REAMING THE SOLID DIES PREPARATORY TO CHASING THE THREAD

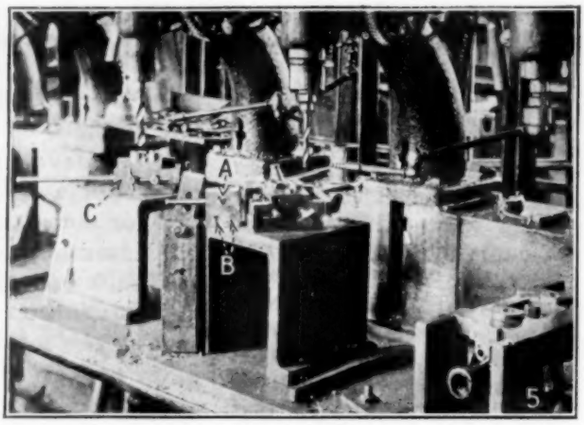


FIG. 5. DRILLING CHASER BLANKS FOR ADJUSTABLE DIES

milling fixture holding a double row of these blanks is used on the machine table, and two sets of high-speed milling cutters are carried on the arbor. A soap solution is used as a coolant and is conveyed to the milling cutters by the pipe *B* in which small holes are spaced every $\frac{1}{2}$ in. throughout its length. To shut off the flow from those holes which would be of no service, small steel spring clips *C* are sprung over the pipe wherever desired.

The corner of one face of the chaser is milled away as indicated at *A*, Fig. 7, using a long holding fixture *B* which contains a double row of these blanks held down by the center blocks *C*. The latter are drawn down by means of fillister-head machine screws. The

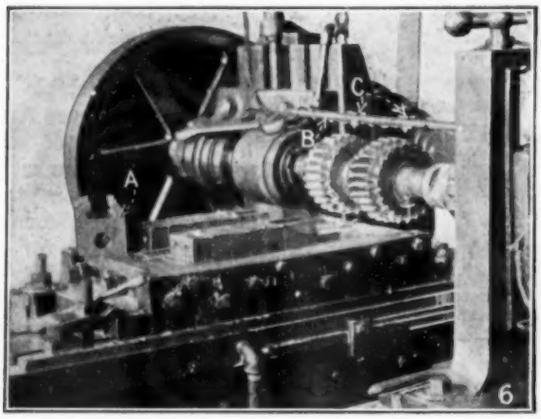


FIG. 6. MILLING CHIP GROOVE AND BEVELED ENDS OF DIE BLANK

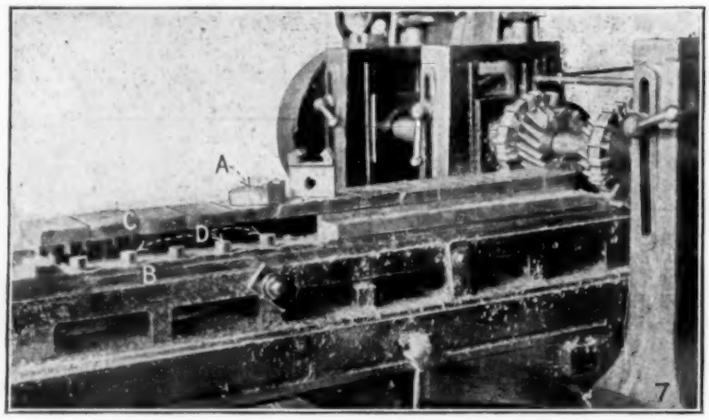


FIG. 7. MILLING OFF CORNER AND FACING END OF BLANK

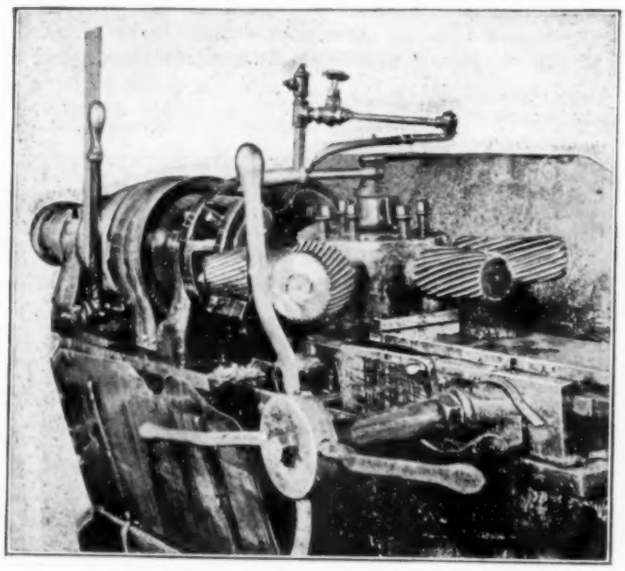


FIG. 8. TAPER-REAMING AND CHASING THREAD OF ADJUSTABLE DIES

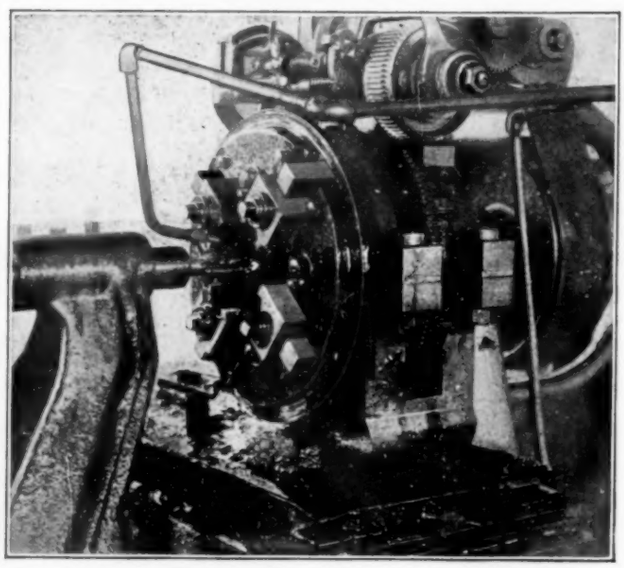


FIG. 9. MILLING RELIEVED THREADS ON LARGE PIPE DIES

blanks are also held in place by means of the dowels *D*, which fit into the large drill holes in the shank. Springs are provided beneath the center holding-down blocks, so that these will spring up and release the work when the screw pressure is removed. It will be noted that the milling cutters face off the ends of the blank at the same time that they are milling off this notched corner, thus insuring accurate length with reference to the center bolt hole, and at the same time saving one finishing operation.

For finishing the dies and chasing the threads of adjustable dies, a special chaser-holding chuck has been fitted on a turret lathe, Fig. 8, and the turret itself carries the necessary straight and taper reamers for finishing the circular portion of the chaser preparatory to cutting the thread. In the position of the machine shown, the thread-chasing hob is at work on the dies which are held in the chuck. A thread-chasing machine for cutting relieved threads on large-type chasers is shown in Fig. 9.

Technical Service to the Customer

By PETER F. O'SHEA

Should a shop offer its customers free service in the technical aspect of the factory product? Is your plant prepared to offer and to supply such service? A good many companies, through their salesmen, are now making such offers to individuals and to the general public through advertisements and standardized sales talks. Such service, particularly when it consists in helping factories to plan new equipment layouts, is invaluable during the present reorganization period.

WHAT is it that makes it worth while for factories to offer technical service? First, let us roughly divide the industries of the country, which worked on war orders, into three classes. The most fortunate was that in which the shops could be turned into making munitions, and to this class war brought prosperity. The middle class consisted of industries which were not granted priority in materials or labor supply, but were nevertheless able to go on existing and turning out their regular product. The most unfortunate class was that which had to suspend operations for short periods during the war, or take up the manufacture of products other than its regular line.

Some companies of the first class were especially fortunate in the continuity of their operations, their product, and their labor force and organization. Greenfield, Mass., for instance, was particularly well situated —as an isolated town of 15,000 inhabitants at the extreme northern end of the Bridgeport munitions district, yet within market distance, and out of the way of the feverish flurry. Considerable carfare intervened between it and the vortex of the munition whirl. A good many of the workmen own their own homes, and the green lawns of the town are noticeable. Freight on household goods was high; consequently, workmen did not move with the first breeze. Furthermore, they did not have to move to get into patriotic war production. Most of the plants in the town went on 100 per cent. Government orders, making what?—the same things which they had been making: gages, taps, dies and other tools in demand by the Government. Men could stay at home and turn out the gages which controlled and enabled the quantity production of small arms and ammunition. A similar situation prevailed with other companies at various points all over the country, which were called upon to continue making their usual products, whether trucks for the army, or rubber tires for the trucks, or other products required for war-time use.

When the war was over it was a simple matter for such industries to go back to their normal peace output. Moreover, the labor force and administrative organization was not only kept intact, but improved and in some cases increased by the extra force that had been trained in the course of the company's efficient work for the Government. It might be thought that such companies have a marked advantage over their less fortunate sister industries. But this is not entirely so. Industries are tied too tightly together, and they hold each other back as well as carry each other forward. The second and third classes, however, will have to reorganize and build up their working force again; the employees will have to be acclimated, or at least re-acclimated; for is it not the employees that make up the factory as a smooth-running productive machine?

Readjustment will be hastened, therefore, by helping people to find out what they need and want, and as soon as an industry gets in readiness itself, it can say to the rest of the industrial world, "Here we are all in running order, prepared to send you or on short notice to make you what you ask, trained to tell you what you specially need, able to design it for you, and anxious to tell you how to use it."

Just now, this sort of service is very valuable to the industrial world and to the customer. It is also very useful to the originating factory in gaining legitimate, permanent business. Therefore, the present period of reconstruction is seeing a great increase in the advertising of service as distinct from goods.

If we look through the advertising pages of this magazine, we will find what applied form this service takes. For example, a manufacturer of taps and dies stands ready to solve problems in screw threads and to have engineers assigned to take up questions of tolerance gages and installation of gage systems; a belting company has a staff of technical men ready to solve individual belting problems; a large sales and engineering corporation renews attention to its service, and so on throughout the list.

Many of the companies now offering service were doing the same thing, either formally or informally, before the war, and most of them gave similar service, intensified and highly valuable, to the Government during the war.

Before a company can advertise service to the public it must have not only a good intention, accumulated knowledge, and experience, but it must have a definite organization to deliver technical service quickly and economically in reply to an inquiry. Of course the idea of service has always been present in an indefinite way in any well-meaning industry, even if it was expressed only by a salesman's informal invitation, "Come up and look us over," or "I'll take that up with the main office and see what we can find out for you." In many companies some or all of the sales force are technical

men, who solve problems of use or give prescriptions on the spot as they meet them. Most plants also have some one available in the sales organization known as the "trouble man," who combines the function of straightening out refractory installations with the function of estimator or layout-engineer on a proposed sale. These methods, however, were administered from the point of view of getting or preserving each piece of business for the company, rather than as an unreserved offer of service to those who knew little about the product. Before advertising service you must have it ready. Perhaps the more simple form of technical service is in the form of printed instructions and advice, or flyers, pamphlets, and supplements to catalogs. The preparation, or at least the printing of this material, falls under the advertising or publicity department. In the office, men must be designated to answer special inquiries and have authority to turn the matter over to someone else for immediate investigation if the matter requires some action stronger than correspondence. A sufficient number of trained, experienced men must be on hand to go to the actual source of the inquiry for investigation, remedy, or recommendation. These men are usually allied both with the sales and the engineering departments of the factory—they are really engineering salesmen.

Inside the plant, besides definite correspondents, certain facilities are necessary, which are already present in a great many plants though they may not be under the direct jurisdiction of the department of technical sales service. A testing room, a research or experimental department, or some individuals and equipment of the engineering department of the factory should also be at the disposal of the technical service. Direct channels of communications and methods for requisitioning the required work are also necessary.

Though only part of the sales force may consist of these technical-service experts, the spirit of technical service soon permeates the whole sales force. This results in greater definite knowledge of the product by every salesman, and greater alertness for sales opportunities.

The technical service men are a direct link between the new and unforeseen needs of customers and the experimental room of the engineering or production departments. They are able therefore to bring in ideas for new products to meet present or future needs, and to contribute mutual aid to the engineering department in development work. They know the customer's needs much better than the ordinary salesman, because they know his shop or his home and the exact circumstances of work.

Of course the best kind of aid to good service is given in the shop itself by the manufacture of quality products. The knowledge, aims and spirit of the technical service department are direct connecting links between the shop and the ultimate reputation of its product. The increased reputation of the product resulting from quality combined with correct use, and the service reputation of the company due to continued development and research work, have a direct effect upon orders, the amount of work, and wages. "It would be foolish for the employees of our company," says one manager, "not to recognize that our company, in order to get the best prosperity, must continue to originate service . . . ." With the new interest that is being taken by employees in the fundamental ideas of a plant, this spirit secures valuable coöperation.

The same need for technical sales service which this period of readjustment has brought about will remain with us after the reaction period since the present moment simply happens to be one when this need is made apparent, definite, and vivid. It is also a moment from which to date a new advance and spread of the service idea. Service will become vogue—in the style.

Technical service has heretofore been developed in certain lines of industry, mostly those lines which serve other organized units of business. Office equipment, factories and branch stores have so established their advisory service that office managers and business men now consult them as a matter of course. Some companies in auxiliary lines have advertised a partial or complete office advisory service free to the public. Builders of machine tools have developed the publicity part of technical service, through instruction and standard practice pamphlets and data. Automobile firms have extended this kind of service directly to the individual public. Even a garage is now expected to respond with correct advice upon any problem in its line.

No sooner is technical service offered by an industry than it undergoes an evolution, the same as that of any other kind of service, so that which started as a free-will offering is not only expected but demanded by the public. The course of evolution is shown in the industries which have already undergone this and similar movements. Once started by one company in an industry, the others have to catch up; and the one which wishes to get a start on the others must originate the service in its line and keep it perfected.

The successive steps in the evolution, past and prospective, may be defined as follows:

1. One leading company in an industry advertises its service.

2. Individual customers are not slow to call the attention of the first company's competitors to the new service, with an implied contrast.

3. Other companies in self-defense establish a similar service.

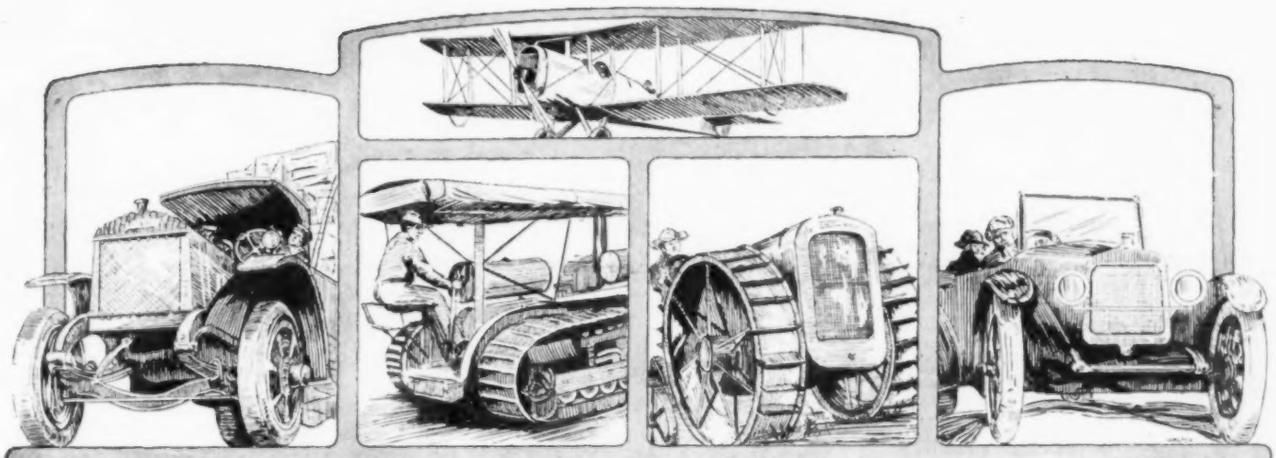
4. The public forgets that the service was originally offered to it as an extra privilege, depends upon it, takes it for granted, and is going to demand it as a right. This demand spreads not only throughout the particular industry, but to other industries.

5. There will spring up an industrial gospel that the factory, where an organization of specialists is gathered together at the source, is the easiest, most efficient, and proper place to develop the technique of the product, including its use, possibilities, and all its problems.

6. The management and employees of each producing company will come to accept as a natural duty the function of solving all technical problems in connection with their product, be responsible for having the solutions available for customers or the public at large, and aim to be in every way specialists in their product.

Indeed, why should they not be?

Companies which have always made thorough investigations, either privately or publicly, of the technical problems of their product have found that the resulting position of leadership has paid a return on the investment. Industries used to be one-man affairs, which might have grounds for fearing that they could not collect individual benefits from their development work. But companies now are big enough and permanent enough so that the same company which starts a broad movement can collect a sufficient share in the result.



AUTOMOTIVE CONSTRUCTION

Caterpillars and Their Construction—II

By K. H. CONDIT
Associate Editor, American Machinist

A distinguishing feature of the "Caterpillar" tractor is naturally the track. Old Baron Munchausen with his stunt of lifting himself by his boot straps would have welcomed this machine as a vindication of his statements to the sceptical.

THE invention of the "Caterpillar" is just one more instance of necessity mothering invention. Out in Stockton, Calif., Benjamin Holt was building farm machinery and traction engines as early as 1890, but, like other traction engines, his were practically helpless in soft ground. The vast delta lands of the San Joaquin were awaiting development, for horses could not work in the soft soils and even the widest traction wheels packed the earth, mired down and stayed there. Mr. Holt was alive to the need and finally hit upon the self-laying track as the solution. It is really a wide chain with steel plates mounted on links to increase the bearing surface. Instead of the contact surface of the round wheel which on hard ground is theoretically a line the width of the tire, the chain track gives a bearing area which is practically the width of the track multiplied by the center distance between the end-supporting rollers. The unit bearing pressure becomes even less than that of the sole of a man's foot and explains why machines of this type do not pack soft ground and are able to navigate under such seemingly impossible conditions. It also explains the disappointment of the short-sighted officer back of the British lines who endeavored to use a "caterpillar" to crush road material. He reported the attempt as "unsatisfactory."

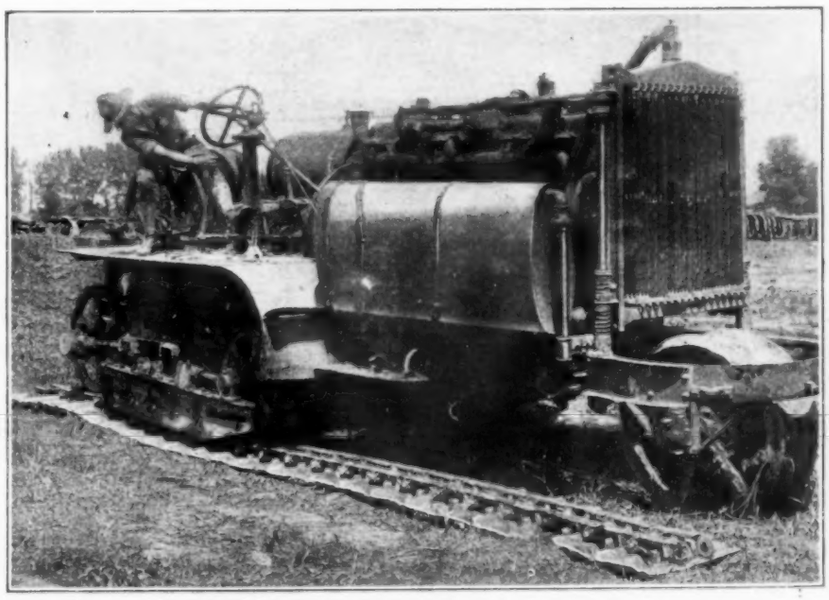


FIG. 6. "120" WITH TRACK LAID OUT

Track details vary somewhat in the different models but the same principle applies to all. A reference to Fig. 6 will give an idea of the main features of the construction. This photograph shows a "120" with one track unlinked and laid out flat. It will be seen that the inner side of the chain forms a straight, flat, double line of short rails on which the weight of the machine is carried by five rollers, three with outside flanges and two with inside flanges, as shown in Fig. 7. The assembly in Fig. 7 is called the roller frame assembly and takes the weight of the main frame through coil springs which appear in Figs. 8 and 9.

The chain runs over the two sprockets, the rear one being the driving sprocket and the forward one a blank sprocket used to support an adjustment. The upper slack between the sprockets is carried on three rollers

AUTOMOTIVE CONSTRUCTION

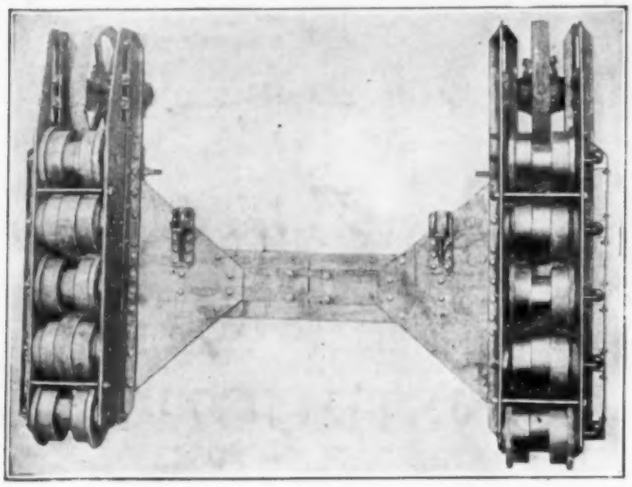


FIG. 7. ROLLER FRAME ASSEMBLY

which can be seen in Fig. 6. Power is applied through the rear sprocket which picks up the chain links on itself, the tractor rolling forward on the supporting rollers.

Fig. 8 shows the method of removing the track. The soft-steel track-pin keeper *A* has been cut with a cold chisel and the track pin *B* driven out, thus disconnecting the chain. The tractor is then backed up until the condition shown in Fig. 6 is reached.

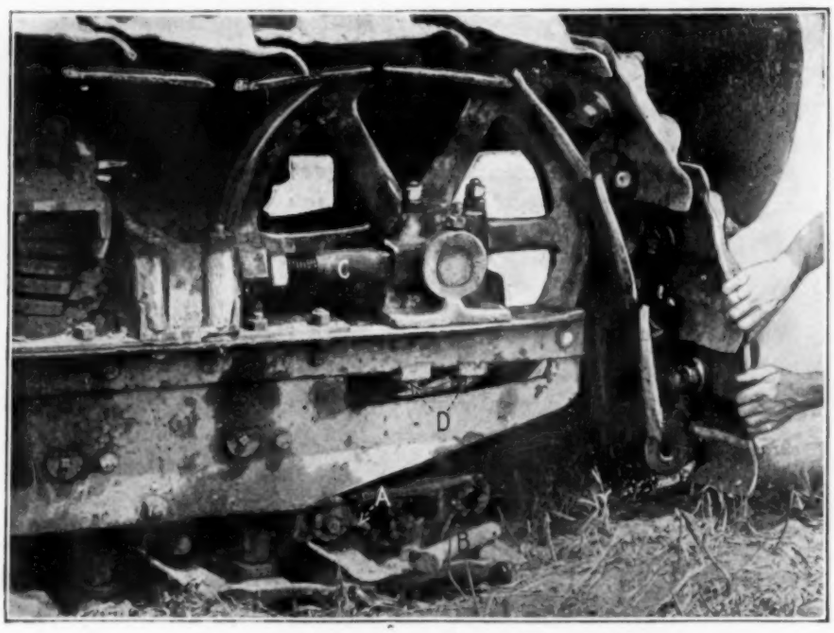


FIG. 8. FIRST STEPS IN REMOVING TRACK

Any necessary repairs can now be made and when they are completed the track will be picked up again with the aid of the chain shown in Fig. 9. In the assembling shop this job is simplified by using a wire cable and an air hoist to help pull the track together. Adjustment of the chain tension is obtained through the spacing rod *C*, Fig. 8, which slides the blank-sprocket supporting bearing forward or backward when the holding bolts *DD* are loosened.

The elements of the chain proper of the "120" are shown in Fig. 10 and consist of the right- and left-track links *A* and *B*, the space block *C* and the track pin *D*. The track links are steel castings and the first operation performed on them is the rough-broaching of the elongated hole for the space block in a Williamson-White punch press. The bottoms are then smoothed up on a Gardner disk grinding machine and the space-block holes finish-broached on a No. 3 Lapointe broaching machine to limits of +0.000 and —0.002 in. The $1\frac{5}{16}$-in. hole for the $1\frac{1}{4}$-in. track pin is then drilled, both right- and left-hand links being set in the jig shown in Fig. 11. The broached openings engage with the locating studs *A* and *B* and the ground lower faces fit against the horizontal locating pin *C*, being held by the locating screws *DD*. Supporting screws *EE* clamp the work in position. The jig is made in two pieces, the upper being slid sidewise along the lower by a spur gear *F* on the end of the shaft *G* acting on a rack mounted on its under side. The hardened bushing *H* guides the drill for the left-hand link. After this is drilled the moving part of the jig is traversed to bring bushing *K* under the drill, location being insured by the stop *L*. The two links are then assembled with a space block and the $\frac{7}{8}$-in. holes for the track shoe and grouser bolts are drilled and reamed.

The space block is made of cold-rolled steel with diameter limits ±0.002-in. and the drilling, chamfering and cutting-off operations are performed in a four-spindle Gridley automatic screw machine. The ends are then milled as shown to limits of + 0.0015 in. The track pin is made by upsetting a head on $1\frac{1}{4}$-in. steel made to S. A. E. specification No. 1020, in an Ajex bolt header. It is drilled for the mild-steel track-pin keeper already mentioned in the foregoing.

The track-shoe for the 75- and 120-hp. models is sheared to size from plow-steel sheets and then formed hot in a bulldozer, the holes for the attaching bolts being drilled. The grouser is a steel casting de-

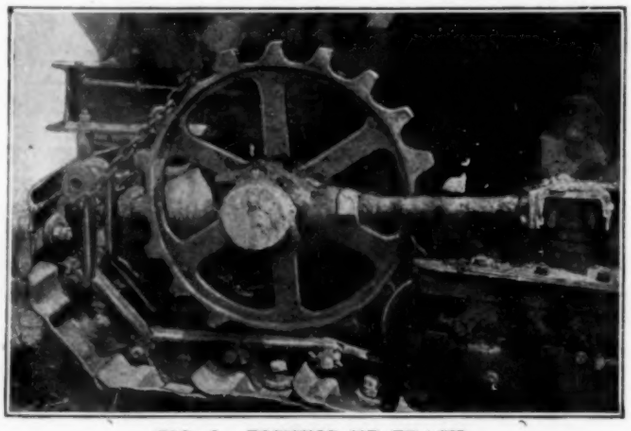


FIG. 9. PICKING UP TRACK

AUTOMOTIVE CONSTRUCTION

signed to give the track a better grip on soft ground and it is held on by the same bolts which attach the track shoe. It is thus practically a permanent part of the tread of the big machines.

Fig. 12 shows the track details in various stages of assembly and also gives a rough idea of the shape of the grouser *A*. In work of this sort it is natural that the sledge should be the most important assembling tool, but its possibilities for damage are minimized by the rather close limits applied to the track lines and space blocks, as already mentioned.

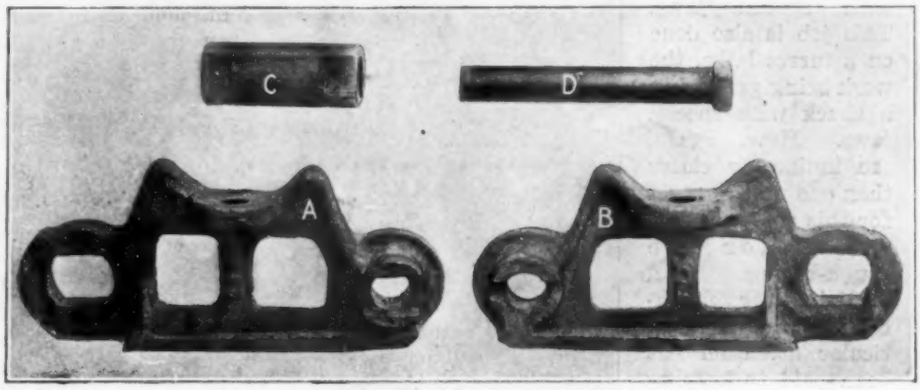


FIG. 10. TRACK LINKS, SPACE BLOCK AND PIN

The track for the 10-ton artillery tractor differs in some respects from that of the "75" and "120." Here the track links, space blocks and track shoe have been combined in one steel casting with satisfactory

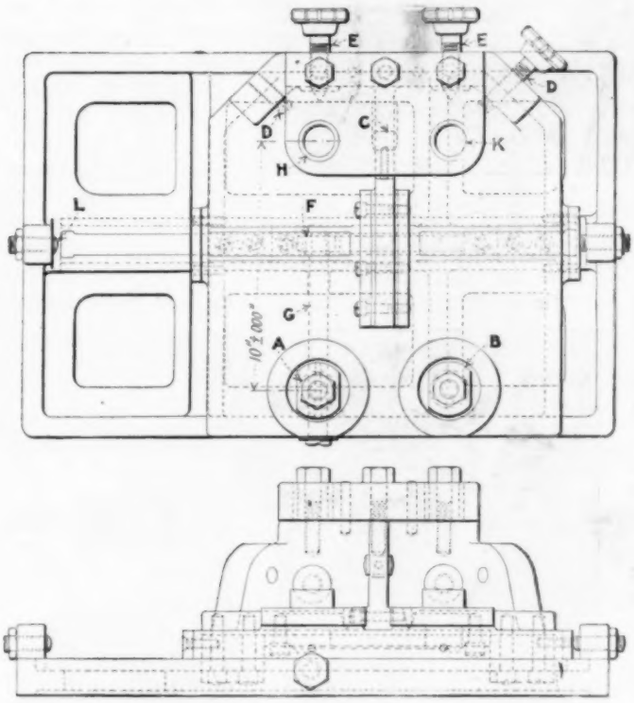


FIG. 11. TRACK LINK DRILL JIG

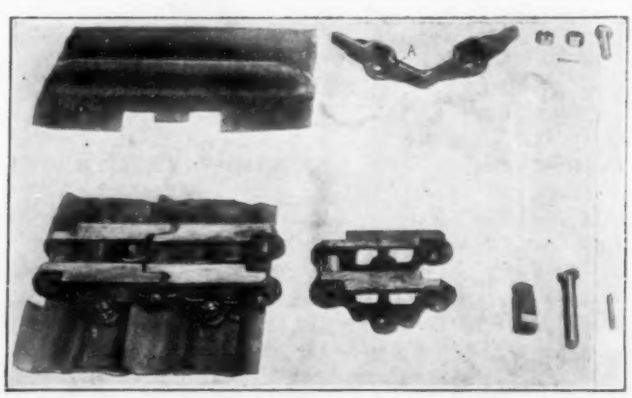


FIG. 12. TRACK DETAILS PARTLY ASSEMBLED

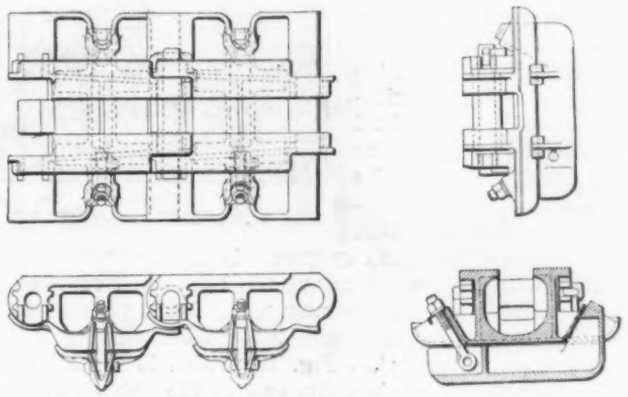


FIG. 13. 10-TON TRACK LINK AND GROUSER

results. Fig. 13 shows the assembly. It will be seen that the grouser in this case is readily removed by loosening one nut, the opposite end hooking over the side of the track shoe. This arrangement was made necessary by objections of French representatives to having their roads ruined by the ugly looking grousers. As a matter of fact, a heavy Holt tractor has been driven over asphalt on a hot day with the grousers on without leaving a mark, so that the danger was more fancied than real. This type of tractor with the grousers off presents a perfectly flat surface to the road and is more a benefit than a detriment. On the army machine the grousers are carried in a steel box under the driver's seat.

Fig. 14 shows the arrangement for drilling the holes in the track link and shoe for the 10-ton. Since this photograph was taken a six-spindle drilling machine has been arranged to do the same job but with two operators. A rotating jig provides for the drilling of two holes in the top of the piece as set up and then two corresponding ones in the bottom.

The inside- and outside-flange track wheels shown in Fig. 15 present additional evidence of the Holt method of finishing farm machinery in the machine shop rather than the foundry. These wheels are semi-steel castings and are fitted with Hyatt roller bearings. The jig used for boring and counterboring the hole is illustrated in Fig. 16. The jig is practically a vise

AUTOMOTIVE CONSTRUCTION

with special jaws. This job is also done on a turret lathe, the work being gripped in a chuck with special jaws. Here, again, the limits are closer than one would expect for this sort of a job, 0.005-in. for the rough-boring and 0.001-in. for finish-counterboring. Particular attention has been paid to keeping these bearings oil- and dust-tight. This is essential to the successful operation of parts that are often submerged in water or mud and usually caked with dirt. To provide for lubrication the track-wheel gudgeon is drilled for three-fourths of its length and the opening tapped for a ⅜-in. pipe plug. Medium cup grease is inserted through this hole with a grease gun until it comes out of the hub. A radial hole taps the inner end of this passage to let the grease out. To keep out the dust and grit four washers are used; *A*, Fig. 15, which is a plain metal washer fitting against the end of the rubber bearing; *B*, a leather washer which is next to *A*; *C*, the dust washer which is a driving fit in the counterbore of the roller; and *D*, the dust collar which fits over the finished end of the wheel hub and has projections which engage sockets in the wheel to prevent rotation, with consequent wear and admission of dirt.

The track itself is provided with an oil reservoir which is so arranged that the track can be flooded with black oil about once an hour. The grade of oil to use will naturally depend upon the season of the year. The sprockets are fitted with grease cups in which a medium grade of cup grease is used.

When the manufacturer has made provision for lubrication that will insure successful running if given a reasonable amount of attention, he has done about all that can be expected of him. Unfortunately, he can't build tractor engineers that function as certainly as machines and sometimes little things like grease cups are overlooked. As one owner wrote in, "The only part of the machine that has given trouble is the operator."

The next installment will take up the various parts of the transmission which is unique in some respects.

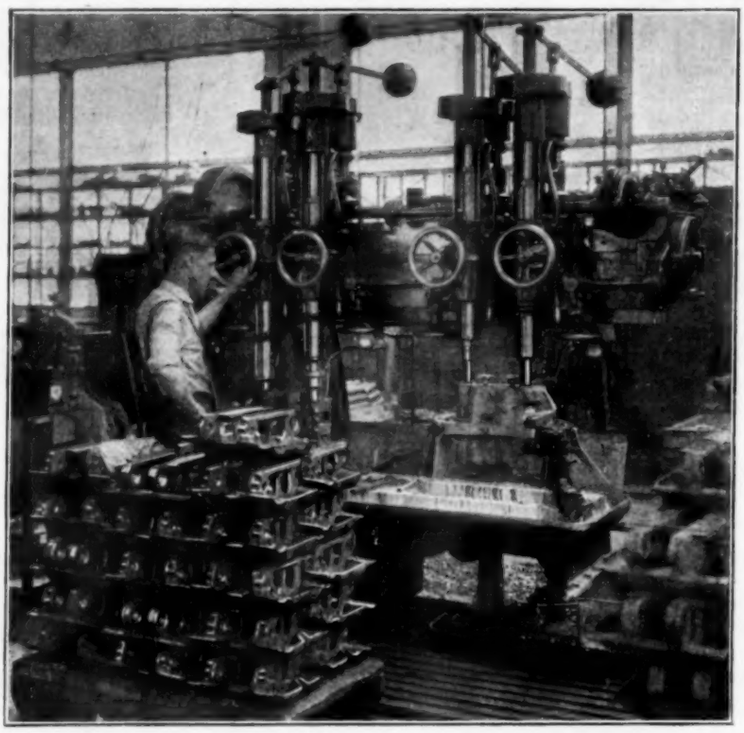


FIG. 14. MULTIPLE-SPINDLE DRILLING OF 10-TON TRACK LINKS

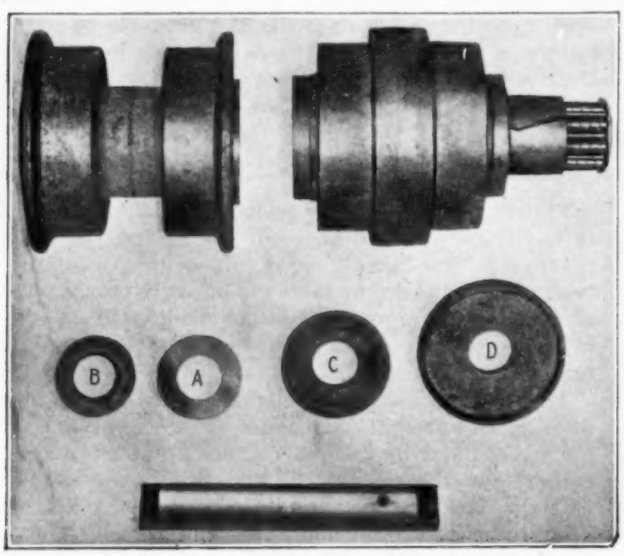


FIG. 15. ROLLER FRAME TRACK WHEELS

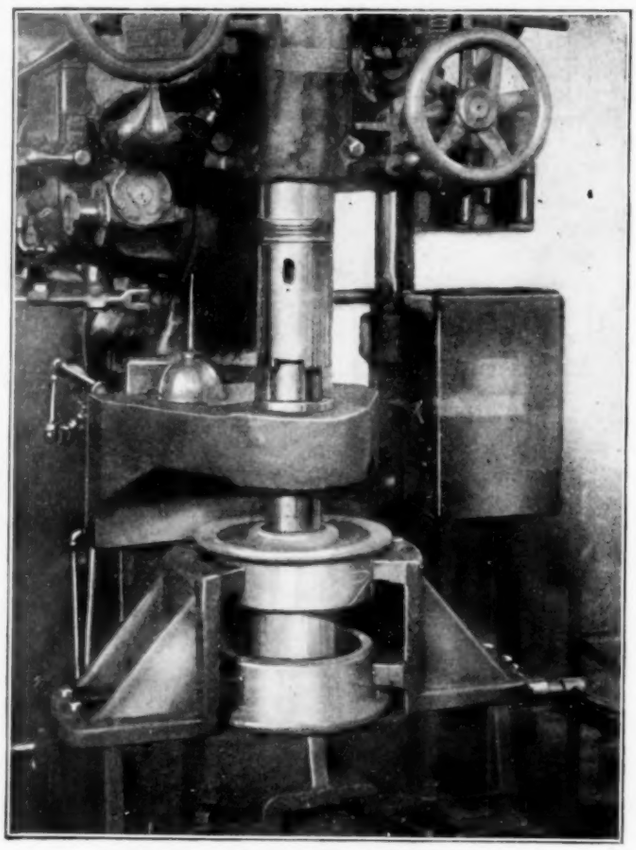
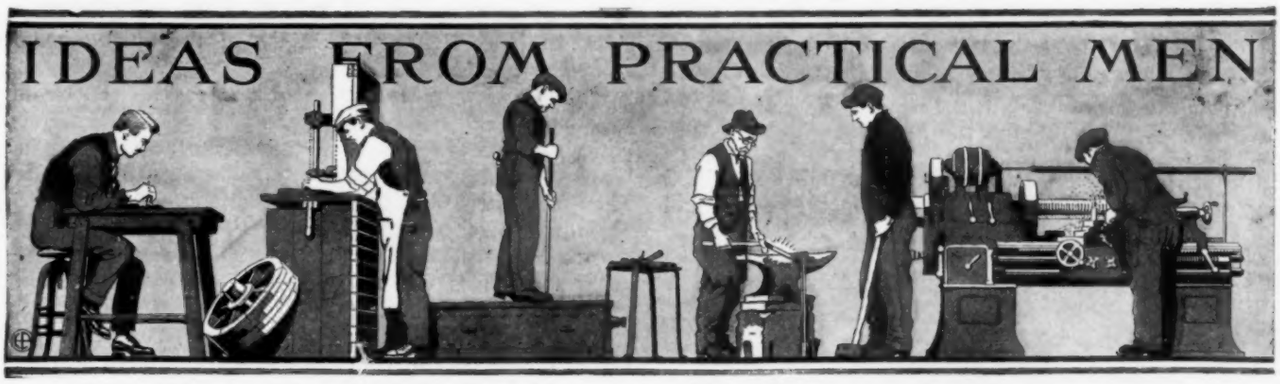


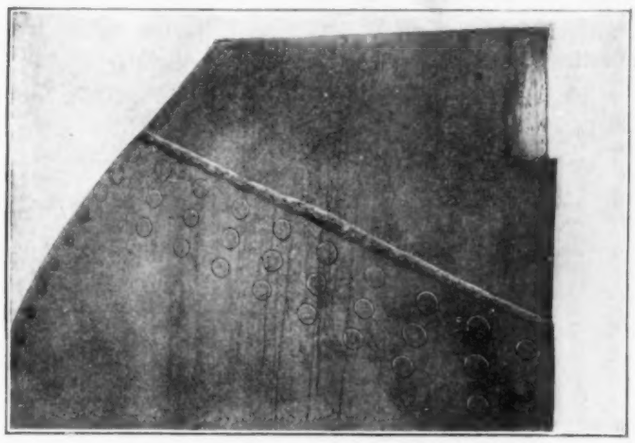
FIG. 16. BORING TRACK WHEELS



Welding a Cracked Rudder

By D. C. Cook

Without a doubt the ship-building industry has offered a wider field for the employment of the welding processes than any other. Many interesting problems are encountered in the fabrication and construction of new vessels, but it is the repair work that taxes the



THE COMPLETED WELD

skill and ingenuity of the welders, and the manner and speed in which they accomplish the seemingly impossible is inspiring.

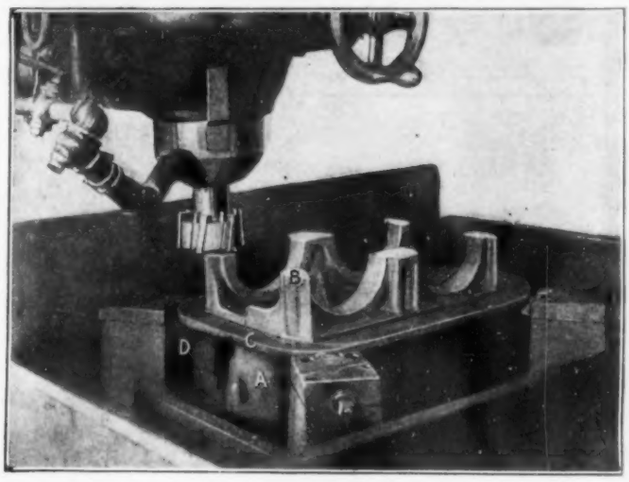
The Reid-Avery Co., Philadelphia, Penn., recently completed a job which is typical of this class of work. After dry-docking, a crack was found in the ship's rudder, and to remove it for repair would involve considerable expense and delay. However, a scaffold was erected about the rudder and the crack quickly filled and welded by the arc-welding process.

Gripping a Cover Flange

By I. B. Rich

A front cover plate for the rear-axle housing on the Autocar truck presents a somewhat complicated problem in machining. The projection *A* carries the bearings for the drive shaft and also takes the thrust due to the beveled gears. The six surfaces *B* contact with six similar surfaces which form the seats for the caps holding the four large ball bearings in place, while surface *C*, which is milled all around the plate, makes the joint with the front of the opening in the housing.

This plate is a rather awkward piece to hold, owing to the necessity for milling its entire upper surface so as to make a good joint. The plate is both located and held by means of four plungers which are shaped as shown at *D* so as to support the lower side of the plate and also grip the outer edge firmly at the four



FIXTURE FOR SURFACING COVER FLANGE

corners. One of the main requirements is to have substantial supporting blocks for the screws in order to exert sufficient pressure to hold the plates firmly.

Preparing Parts for Local Case-Hardening

By Matthew Harris

Where articles are to be locally case-hardened it is generally the practice to electroplate the part to be left soft with copper. To prevent the copper from being deposited on the part to be hardened, that part is coated with paraffin.

As the copper has no affinity for carbon the part so coated will not be carbonized when heated in the carbonizing compound.

At the works of the Dayton Engineering Laboratories Co., Dayton, Ohio, they have a large quantity of small

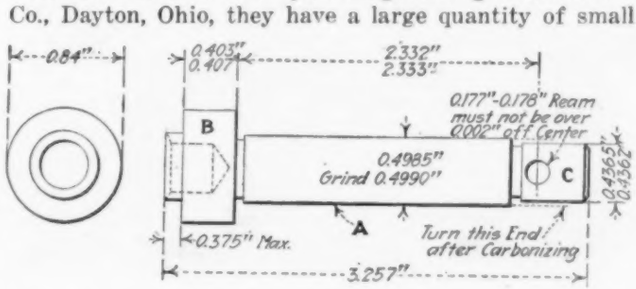


FIG. 1. THE SHAFT TO BE COATED WITH PARAFFIN

shafts, Fig. 1, that are to be case-hardened at *A* while the ends *B* and *C* are to be left soft. Formerly, the part *A* was brush-coated with melted paraffin but, as there were many shafts, this was tedious and great care was necessary to avoid getting paraffin where it was not wanted.

To insure uniform coating the device shown in Fig. 2 was made. Melted paraffin is poured in the well *A* and

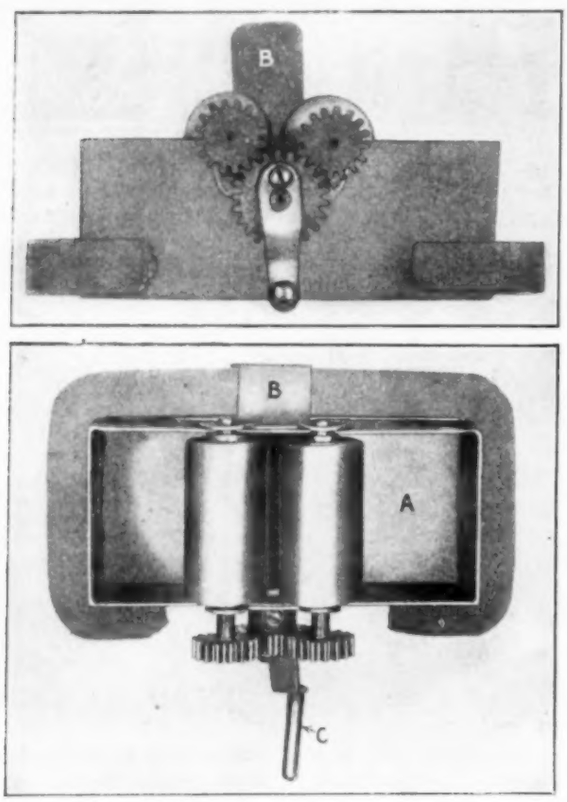


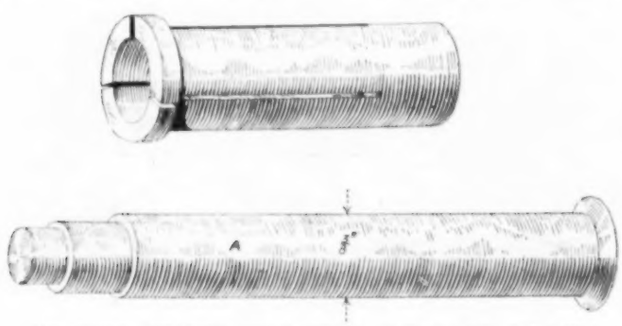
FIG. 2. DEVICE FOR COATING THE SHAFT

kept liquid by setting the device on a hot plate, the paraffin being kept high enough to touch the bottoms of the rollers. The shaft to be coated is laid between the rollers with one end against the gage *B*, when a turn or two of the crank *C* will cause it to be evenly coated.

An Auxiliary Collet for Holding Headed Pins

By Gustave A. Remacle

It sometimes happens in die work for die-castings that core pins have to be turned in the bench lathe after they have been headed at the opposite end as



HOLDING HEADED PINS WITH AUXILIARY COLLET

shown at *A* in the illustration, and the head will not allow the insertion of the piece in the spring collet from the outside.

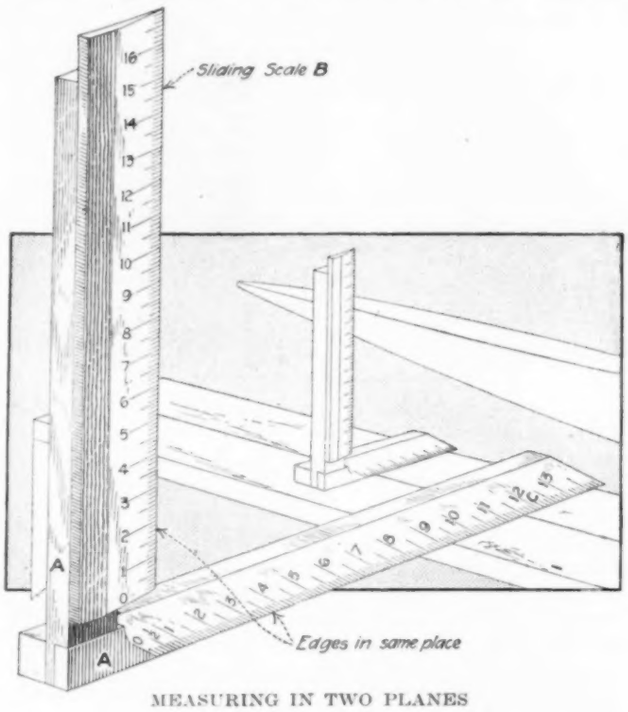
If but a few pieces are to be made the collet can be removed and the piece inserted from the rear end; but when constructing dies for casting airplane ball-bearing holders, many such core pins had to be made. Therefore, in order to save the time which the repeated removal of the collet would make necessary, an auxiliary collet was made.

Circumstances did not warrant the hardening and grinding of this auxiliary collet but care was exercised in its making and it was marked so that it could be placed in the regular collet in the same relative position every time, thus minimizing any slight errors that might exist.

A Gage for Laying Out Work in Two Planes

By Raoul J. Hoffman

The sketch shows a tool that is of advantage in laying out work where simultaneous measurement in two planes is required, as for instance in laying out or inspecting the contour and alignment of an airplane pro-



MEASURING IN TWO PLANES

peller, where the measurements are given from a center line and from the face of the propeller.

The base of the tool is a block of hard wood of rectangular section and of whatever length is desirable. One of the narrow sides is beveled to an edge for the greater part of its length and graduated, beginning at zero which coincides with the edge of the vertical scale.

The upright, which must be square with the base, carries a beveled-edge scale with its edge in the same plane as the horizontal scale. This upright scale is adjustable up and down so that its zero point may be made to coincide with whatever surface may be used as the point of departure in making measurements in the vertical plane.

Machining Problems Solved in Gun-Making—II

By J. V. HUNTER
Western Editor, *American Machinist*

The accuracy required in machining heavy pieces has frequently in the past made an exceedingly slow process of setting up the work for the cuts. These delays have largely been avoided in making the 4.7-in. gun by numerous special gaging devices, which are described for the benefit of all machine-tool men.

WHEN the jacket has been shrunk on the tube the body is turned, Fig. 18, for the shrinkage surface of the locking hoop. A closer view, Fig. 19, shows a number of gages made to fit every portion of the threaded profile of this part. After shrinking the locking hoop the gun is finish-bored in a Lodge & Shipley gun-boring lathe. For truing the muzzle end in the four-jaw chuck, Fig. 20, a micrometer *A* is used to true the steadyrest surface which was finished in one of the early operations. The arrangement for holding this indicator consists of the parallel bar *B*, which is laid across the ways of the lathe and carries the bracket *C* with the heavy bar *D* for holding the indicator, thus enabling the operator to center the piece to 0.0005 in. The breech end of the gun with the boring bar about to enter the wood-packed reamer is shown in Fig. 21. The bore has previously been opened up to a depth of from 3 to 4 in. and to the full diameter of the reamer by a special attachment which was described in a previous article. The Northwestern Ordnance Co., Madison, Wis., has devised a unique method of boring the powder chamber and the forcing slope of the bore, and of facing the breech end to length in a long Gisholt turret lathe, Fig. 22, which swings the entire length of the gun in the same way as in

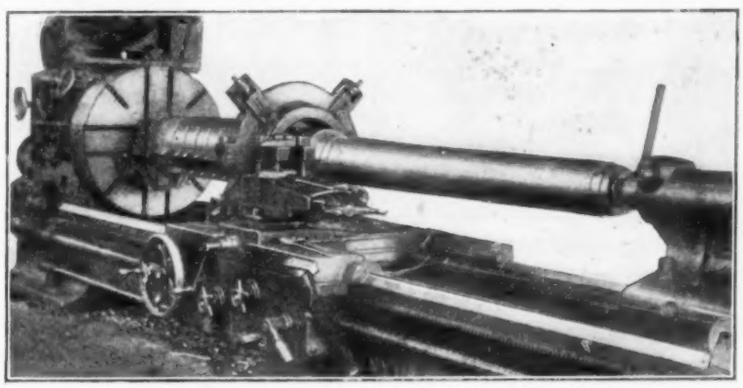


FIG. 18. TURNING SHRINKAGE SURFACE FOR LOCKING HOOP

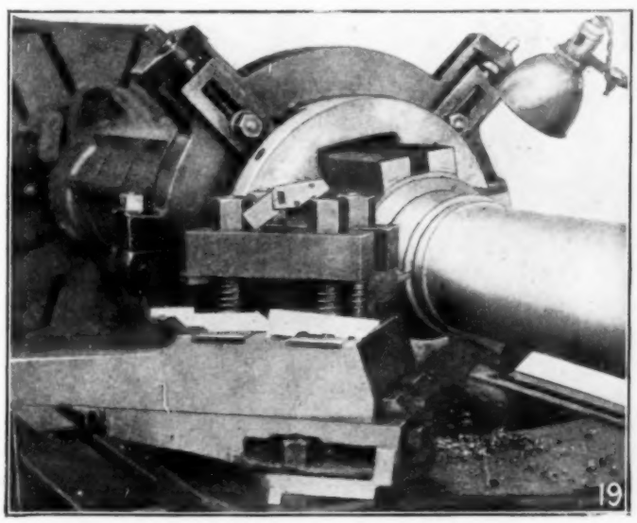


FIG. 19. FINISHING THREAD SURFACE FOR LOCKING HOOPS

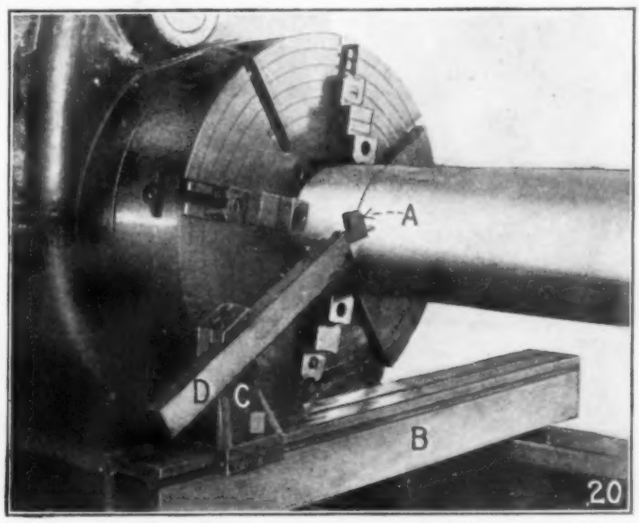


FIG. 20. MICROMETER DIAL USED FOR TRUING MUZZLE END

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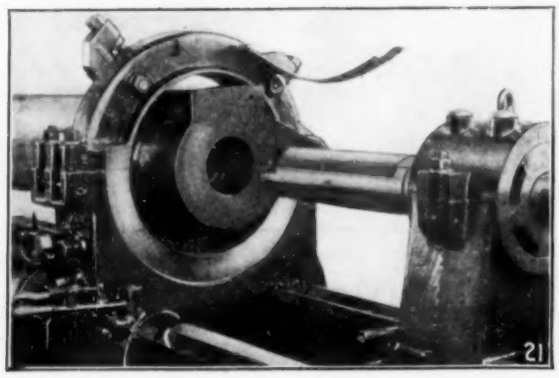


FIG. 21. FINISH-BORE REAMER ABOUT TO ENTER GUN

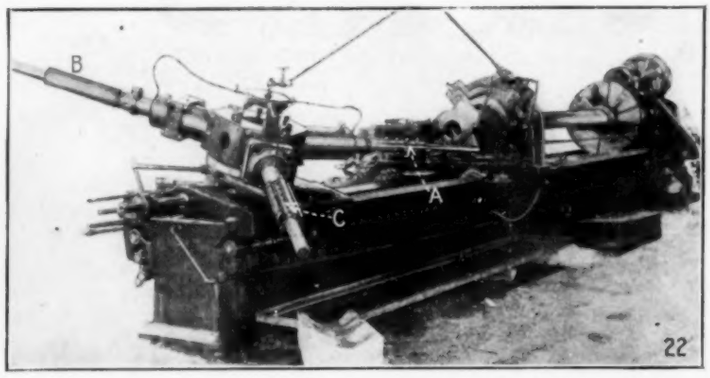


FIG. 22. LARGE TURRET LATHE USED FOR FINISHING POWDER CHAMBER

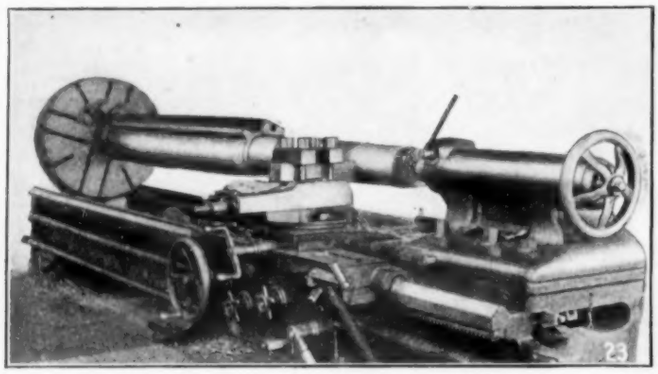


FIG. 23. TURNING MUZZLE END FOR FRONT CLIP

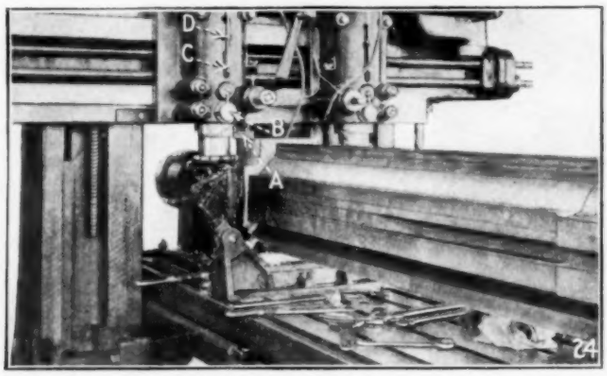


FIG. 24. MILLING OPERATION ON BREECH END

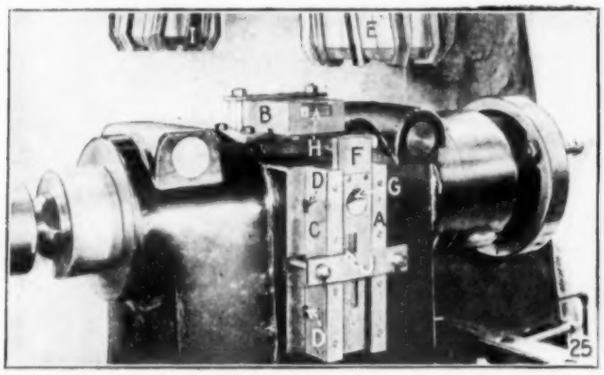


FIG. 25. SPECIAL GAGING DEVICE FOR SETTING UP MILLS

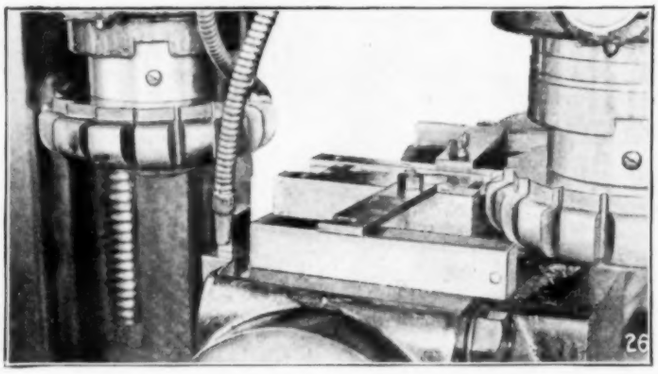
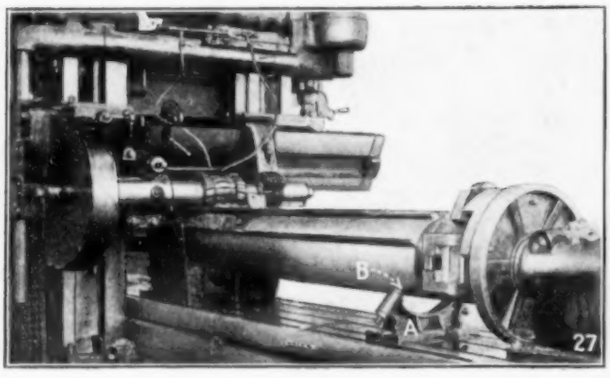
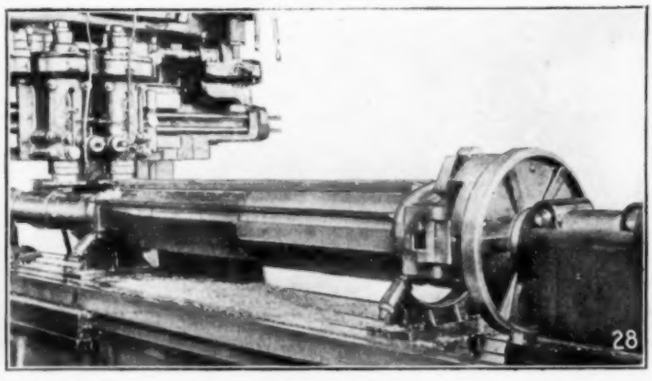


FIG. 26. GAGE USED IN SETTING UP FORM MILL





FIGS. 27 AND 28. MILLING OPERATION ON GUN-SLIDE GUIDES

Fig. 27—Heavy milling cut on gun body. Fig. 28—Milling the grooves in slide guides.

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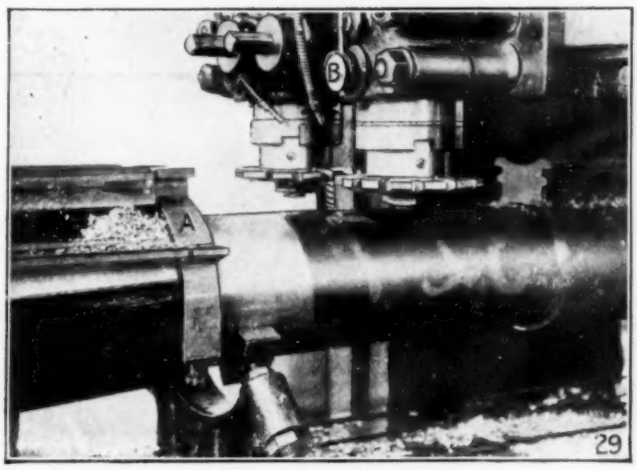


FIG. 29. FORM GAGE USED FOR SETTING MILLING CUTTERS

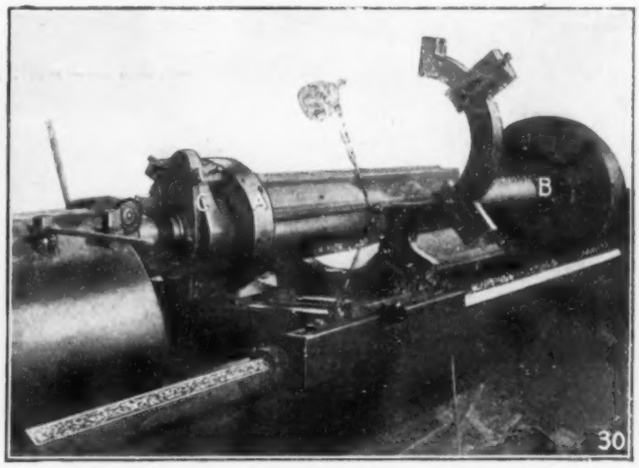


FIG. 30. OFF-CENTER PLUG USED IN SETTING UP FOR BORING BREECH

a standard gun-boring lathe, but employs turret-head tools for boring and reaming. On this turret head the boring bar *A* is used for the first roughing cut. This is followed by a cut from the semi-finish reamer *B*, and a final finish by the wood-packed reamer *C* insures the accuracy of the powder chamber and forcing slope. The standard lathe carriage with facing-off tools finishes the end of the breech to length. Turning of the muzzle end of the gun in a Bridgeford lathe, Fig. 23, completed the lathe operation for the time being.

The improvements in the methods of gaging for setting up milling cuts are worthy of special attention and might be adopted profitably in other lines—taking as an example the set-up that involves milling the two sides of the breech end simultaneously after finishing the top surface. Fig. 24 shows a small gage *A* which rests on the top finished surface and extends to the upper face of the milling cutter, thus indicating how high to raise the cutter.

However, in addition to this gage there is a micrometer-dial attachment *B*, which is mounted on the frame of the milling-machine spindle. When the gage *A* has been placed and the spindle drawn up to the proper height the rod *C* is lowered until it forces a reading of perhaps 0.125 in., and the dial turned back to read zero without disturbing the indicator finger. The rod *C* is carried on the stud *D*, which is equipped with an adjusting thumb nut and is fastened to the spindle of the milling cutter. It is the custom to take a rough and a finish cut, and after the cutter has been set by the gage *B* the micrometer dial is of service to the operator who now raises the spindle until the dial indicates that he has backed out the cutter a distance of possibly 0.050 in. After the roughing cut is made the spindle is lowered until the dial again reads zero, and is then in the correct position to proceed with the finishing cut.

Gages for setting milling cutters are illustrated in Fig. 25 at *A* and *B*. All gun work is located to some extent with reference to dimensions given from the center of the bore, and during the majority of the milling operations on the breech end and slide guide portions of the gun body it is carried on centers which are accurately located in the bore; consequently, when located for milling cuts such as those shown in Fig. 24, it is supported by the center head more clearly shown in Fig. 25.

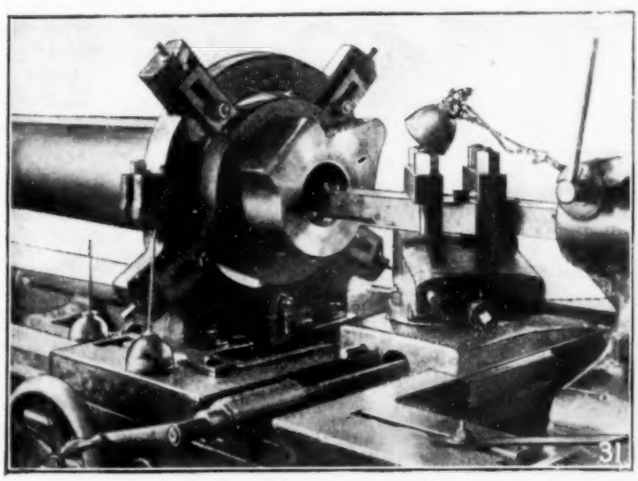


FIG. 31. CUTTING BREECH-LOCKING THREADS

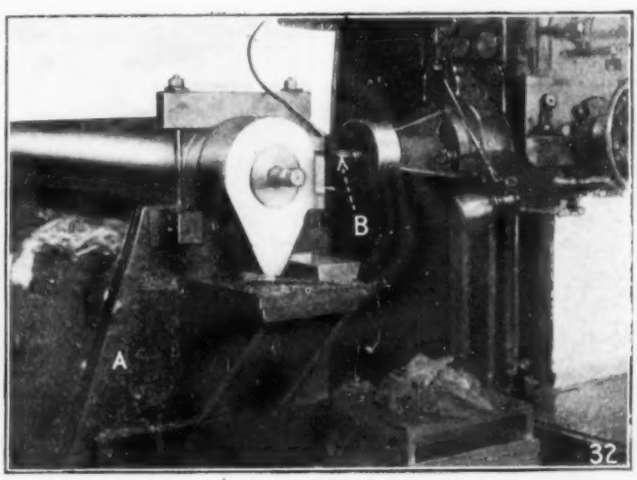


FIG. 32. MILLING OUT HINGE-LUG RECESS

ARMY ORDNANCE NEWS

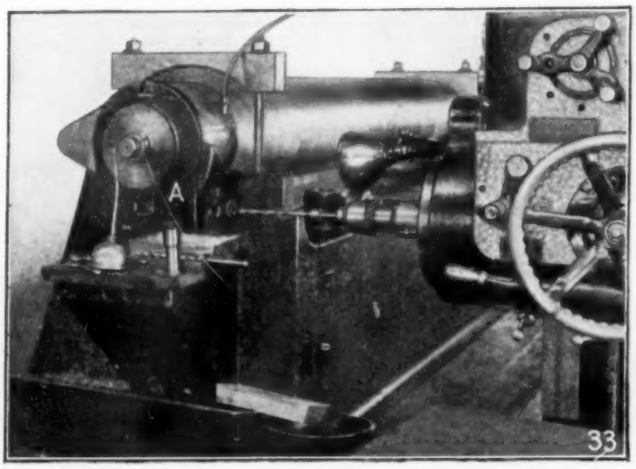


FIG. 33. DRILLING AND BORING FOR HINGE-PIN HOLE

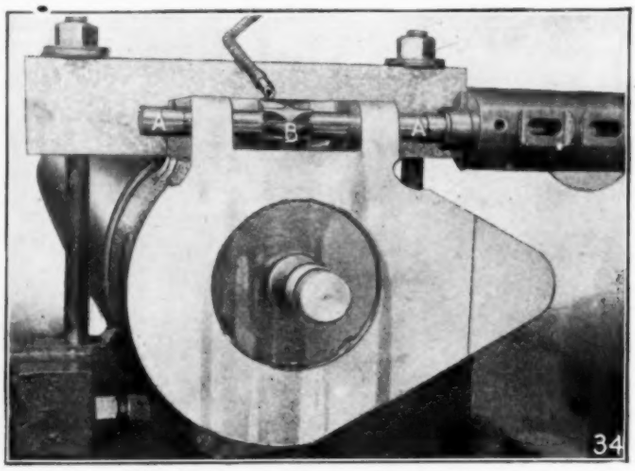


FIG. 34. RADIUS-MILLING BACK CORNER OF HINGE POCKET

The gaging devices *A* and *B* are made up of the main body *C*, which has on its back face three key slots *D*, which enable it to be placed in any one of three previously determined positions with respect to the center. When the gage is placed in position the milling cutter *E* is lowered until its cutting edges come into contact with the hardened-steel plunger *F*. This plunger is free to retreat a certain distance, but while so doing it moves a small indicating finger across the glass-covered dial *G*, which reads plus or minus thousandths from a central zero. By moving the cutter sideways against the corresponding plunger *H* of the gage *B* the distance laterally from the center of the gun bore can be fixed. By transferring the gaging device *A* to the rear side of the headstock and by turning the gage *B* end for end the cutter *I* may be similarly aligned for correct position. This type of gage will serve for other types of milling cutters, as illustrated in Fig. 26, which shows a form mill being set by means of an indicator located on top of the center head.

If the cutters are not to be equally spaced from the center certain changes can be made in the indicator either by setting the body into another of the key slots or by changing a plug *J*, Fig. 25, which fits inside the mechanism and controls the lever movement of the indicator finger.

A heavy milling cut on one of the slide guides of the gun body is shown in Fig. 27, a feature of which is that the indexing center for the breech end is provided with an additional support *A*, which rests on the table of the milling machine and takes up the heavy downward thrust of the milling cut and the weight of the body on the adjustable screws *B*.

Cutting the grooves in the under side of the slide guides, Fig. 28, is another heavy milling cut. The form gage *A*, Fig. 29, used for aligning these milling cutters, is simple in design and bolts into place over the portion of the gun tube which was accurately machined for the shrinking of the locking hoop. Micrometer-dial gages *B* are used for setting up the milling cutter for the roughing and finishing cuts. Micrometer dials, not shown, are attached to the crossrail of the milling machine with adjustments that press against the milling-cutter spindle column castings and are used to gage lateral movement.

On account of the loading tray (a device which protects the breech threads from being injured by the shells) which lies in the bottom of the threaded portion of the breech it is necessary to offset and bore the threaded locking section of the breech block $\frac{3}{8}$ in. below the center of the gun bore. To do this the cathead ring *A*, Fig. 30, is fitted by mounting the gun in a lathe, with the muzzle end held in a pot chuck *B* and the breech end supported by a special $\frac{3}{8}$-in. offset center plug *C*. The cathead ring is turned outside to insure that it runs true with the centers, and after remounting with this support the threads are cut, Fig. 31.

The many recesses in the hinge pocket and breech end are finished in operations employing several large Landis vertical-column milling machines. During the work on the hinge pocket a special heavy cast-iron base *A*, Fig. 32, that was built in the toolroom holds the body while the end mill *B* is cutting out this recess. The gun body is then turned over and a large jig plate *A*, Fig. 33, is placed to guide the drills and boring bars used for finishing the hinge-pin hole.

For radius-milling the back corner of the hinge pocket, Fig. 34, the gun is revolved 90 deg.

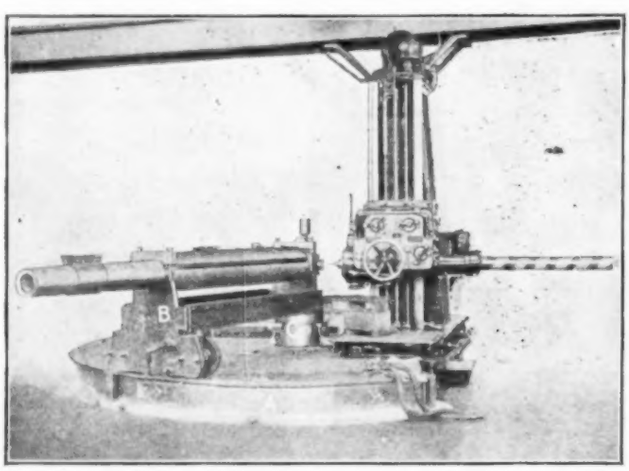


FIG. 35. SPECIAL PIVOTED GUN FIXTURE ON MILLING MACHINE

from the first hinge recessing position, and the arbor *A* is slipped through the hinge-pin hole and carries the double-end mill *B*, which is held in place by a key and setscrew. This makes a satisfactory method of handling work of this character and insures a clean radius cut at each corner without the customary laborious work of chipping and filing them.

Fig. 35 shows the setting of a similar Landis vertical-column milling machine equipped with a special cast-iron runway and concrete base *A*, upon which the carriage *B* travels, being pivoted at the farther end *C*. This permits the operator to cut the various angles required in recessing for the extractor. It will be observed that the spindle-covering shield of the machine extends to the right far beyond its base, and to make this conspicuous to prevent it from being bumped by moving trucks or workmen it has been painted with a black-and-white spiral.

A Man's Pay Should Equal the Value of His Production

By JOHN S. WATTS

IF THE regulation forming the title to this essay can be exactly conformed to, we will be in a fair way toward the solution of the present unrest and dissatisfaction. That is, if we could definitely decide the relative values of all the various classes of labor (manual or brain), and so be in a position to state definitely that a specified kind of work performed in or during a period of time, was equivalent to a certain amount of money, and everyone was paid in accordance therewith, we would all be satisfied that we were getting an amount of remuneration equal to, or rather, that would purchase, our share of the world's production.

For if the relative value of our labor is truly calculated, and we all are paid that value, it is obvious that each worker's pay will be equal to his production, the total amount paid out to all the workers being equal to the total production, assuming that there is no so-called unearned increment.

The main defect in our present methods of payment is that there is no fixed relationship between the amount of money in circulation, or in the amount paid for the labor of producing, and the amount of goods produced or on the market, this being the cause for the fluctuation in the purchasing value of our monetary unit. The effect is that we agree to perform work for a sum of money, the value of which sum is problematical.

The dollar, therefore, has no fixed value in terms of produce, and neither has it at present any definite value in terms of productive labor; that is, the amount of work (manual or brain) which will earn a dollar varies both in quantity and quality in the same locality.

If the amount of production (that is, labor multiplied by hours, required to earn one dollar) varied automatically with the purchasing value of the dollar, the problem would be much less intricate, but it does not.

The dollar, therefore, which is our unit of value just as the inch is our unit of measurement, is about as useful a unit as a 12-in. scale would be that might shrink to 6 in., while still purporting to measure 12 inches.

It is manifestly impossible to fix the purchasing value of a dollar, as all commodities will vary in their relative value in times of shortage of one class and over supply of another. For example, if we make a certain quantity of wheat equal to one dollar, and another fixed quantity of potatoes to be worth the same amount; then when wheat is plentiful and potatoes scarce those who wish potatoes will certainly offer a premium for them, and the excess wheat would go unsold unless the price were reduced or some other inducement offered to persuade people to purchase it.

Therefore, it will be necessary to fix the value of the dollar in terms of a certain amount of a certain quality of work; and from that, the value of all other qualities of work in as near as humanly possible the exact ratio the other qualities bear to the first or standard quality in productive efficiency. By productive efficiency I mean the amount or value of production that the said quality of work will produce, divided by the value of the production of the standard quality of work.

The standard unit could be the value produced by the labor of an unskilled man, working for one hour, with some simple tool such as a spade, and without assistance from a skilled supervisor.

To elucidate this I will give a simple example of what I mean by productive efficiency and the fixing of the value of a man's production.

We will assume that the unit of labor value defined above is equal to one dollar; it follows that ten men doing this quality of work will produce 10 dollars in value in one hour. If a foreman is appointed over these men, and by reason of his superior knowledge and experience his supervision of the men results in their producing 12 dollars in value in the same time, and with the same tools and physical effort, then the foreman's productive ability is two dollars per hour, and his productive efficiency is 200 per cent. If the men's pay is one dollar per hour, the foreman's will be two dollars per hour.

It may be contended that the natural laws of supply and demand do regulate a man's wage in accordance with the value of his production, but, while this may be approximately true as to the total amount paid for the production of an entire business, it is decidedly not true as to the wages paid the various qualities or classes of labor engaged in that business.

For instance, the price of machine tools may be said to be fixed by the law of supply and demand, and hence the total pay of all the labor entering into their manufacture.

The division of this pay, however, among the various trades is not, I contend, fixed by the aforesaid law but by the strength of the trade's unions.

Compare the pay of the operator of an automatic machine, requiring only such skill as may be acquired in a day or two with the pay received by the draftsmen who design the machine, the latter spending many years acquiring the necessary knowledge. The pay of these two classes is practically equal because the operators have a union and the draftsmen have none.

Their productive values are nowhere near equal as

the designers have produced a machine which may double or treble the output of the operator, with less physical effort on his part than would be necessary to produce the same value in any other way.

It must be remembered that the true production of the operator does not equal the output of the machine, as this latter includes the production of the designers and mechanics who built the machine.

The true value of the operator's production will be the standard unit defined above plus a percentage added for the skill necessarily acquired on his part to operate the machine.

In choosing the above example I have no animus against the machine operators, nor does this apply any more against them than against any other trade with a strong union. All trades and professions are out for all they can get. And in the absence of any attempt at scientific determination of the respective relative values of the various kinds of work, who can say when a trade is getting its fair rate.

It is only when we can come to compare the amount of effort and brain work required to earn a dollar in one business with the ease with which a dollar can be earned in another trade, that we see the need for some way of calculating the true comparative values of the various kinds of labor, other than the method now in vogue of settling it by a trial of endurance between the employer and employee. The employers frequently put up only a half-hearted fight, as in the generality of cases they know they will finally pay up and simply add the extra cost to the price of their product. The rest of us pay in the end.

If, by reason of having a strong organization, a certain less skilled part of the population can obtain more than its share of the products there is no incentive for our young men to become skilled, which is what is actually occurring, and in time this will cause a lack of skill, and hence a lack of production.

Again, the present method of getting increased pay results in increasing the cost of living, which brings further demands for increases, and so on ad infinitum. The final result will be that those skilled professions without organizations to protect them will become so poorly paid that no one will be left to carry them on and chaos will result.

If it were known that wages were fixed in a true relation to the value of the production for which the wage was paid, the lowest intellect would see that only by increasing production by either or both increased physical effort and greater skill, could the cost of living be lowered, or what is the same thing, a larger measure of the good things of life for all of us be obtained.

The conclusion I arrive at is that it is imperative, if our civilization is not to be left to wreck itself on the rocks of ignorance and greed, that the channel of a fair day's work for a fair day's pay, be charted so plainly that "the wayfaring man though a fool may read."

It may seem, and probably is, a tall order to fix the true ratio between the value in production of say eight hours of pick and shovel work, and eight hours of navigating a liner. But in my opinion the problem has got to be solved and that soon, or in the near future the less thoughtful of the manual workers who are in the majority will take what of value there is by brute force, and being unable to control the intricate mechanism of our civilization, bring the whole structure to an end in barbarism.

An instance was given above of a suggested method of fixing the productive value of a foreman's work which should be the standard method and used wherever applicable. In cases where the production was too indirect to measure by that method, it would be possible to arrive at a fairly just rate by taking account of the length of time it took on the average to learn to do the class of work in question. Further percentages would be added for work in dangerous or disagreeable occupations.

While it is not to be expected that at first all rates of pay would be mathematically exactly in proportion to the true value of production, the law of supply and demand would operate to correct any slight errors by reason of the elimination of false methods of fixing rates of pay by strikes, etc.

I claim that elimination of strikes would follow the inauguration of this system, because if the whole community (through a competent commission) decides fair and just rates for all trades and professions, precisely as the rates of taxation, laws, etc., are decided and accepted by all, then any body of men who set out to demand more would have to convince the people of the justice of their demands or failing that fight the whole population.

At first sight it may appear as though the above method would result, by reason of paying the skilled men more, in the less skilled men getting a poorer living than they do now.

The actual effect will be the reverse, for the following reasons:

The production of all goods will be increased by reason of the continuous production due to cessation of strikes and lockouts, and with increased production we get decreased costs.

The more closely we come to paying to a man the actual value of his production, the greater will be the incentive to become skilled in producing value, and hence more will be produced, and there will be more to divide.

What We Can Do For 1920

THE New Year — 1920 — promises to be one of the most critical in history. The war is over and boundary lines are apparently settled for the most part. But the future of the world depends on far more than geography. It depends on the relations of men and of people—in the shop and office, in business, and between cities, states and countries.

All these relationships, however, get back to the personal—to the way in which we treat others and are treated by them. And the future depends on each one of us in no small measure.

Instead of the usual new year resolutions, let us try to make ourselves realize that we can each play a part in making the future better for all concerned.

Let us all remember that Duties are just as important as *Rights*.

That the world demands, and has a right to demand, *Service* in return for what we get out of it.

That unless we treat the other fellow as we would like to be treated, we cannot expect harmony and co-operation.

That without co-operation, we cannot hope to increase production which is so sadly needed.

And then let us earnestly resolve to give in full measure, the service that is required of us, so that we may have the right to expect the same of others.

Necessity for Keeping Grinding Wheels in Perfect Balance

By J. H. HOLLINGER
The Landis Tool Co.

On page 1228, Vol. 50, in the *American Machinist*, John H. Peckham writes under the above title, on the effect of unbalanced wheels. It is a well-known fact that the chatter is the worst enemy of the grinding machine. There are times when a piece of work may look perfectly smooth; its surface may not appear to have a blemish under the closest inspection, and yet the instant a neat-fitting bushing is rubbed over it imperfections begin to show up. The marks which appear are in the form of chatter but no instrument has been found delicate enough to measure it, and it has not been known to give any trouble. Nevertheless, we are constantly fighting this imaginary evil; wheels and pulleys are balanced, uniform belting is selected, and the machine made heavier throughout, all of which make for improvement.

There is one thing which should never be forgotten: "The nearer we come to perfection, the harder it is to get."

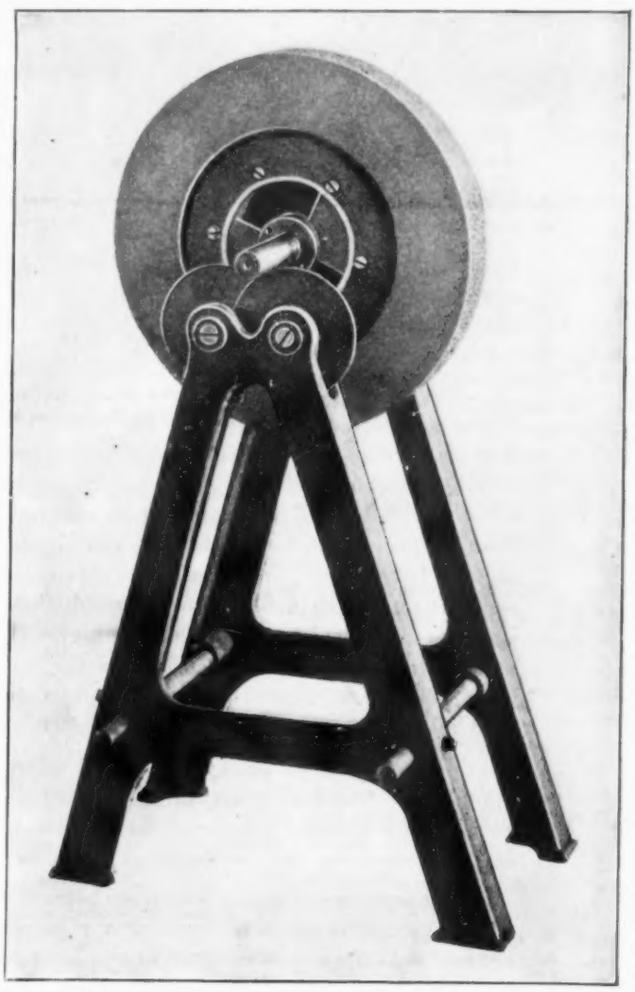
It is impossible to overcome wear; after a machine has been installed, adjustments are often not properly kept up and as long as the finish on the work is good enough it is let go at that; if the grinding machine is kept tuned up, first-class results can be looked for.

As an example, Mr. Peckham states that an 18-in. diameter wheel (width not given), 1 oz. out of balance and running 1360 r.p.m., exerts a force of about 25 lb. every revolution, and this continued pounding in the wheel-spindle boxes will in short time wear the boxes and spindle egg-shaped. While I am opposed to unbalanced wheels and am an enemy of vibration, I do not believe that an 18 x 2-in. wheel, running 1360 r.p.m. and out of balance 1 oz., will wear the boxes and spindle egg-shaped in a short time, or imperil the operator's life. It is a very rare thing indeed for a wheel on a precision grinding machine to break and I have no knowledge of any wheel breaking due to being out of balance 1 oz. The breaking of a wheel is generally caused through rough treatment by the operator. Jamming the wheel against a shoulder on the work, the driving dog or the head or foot stock should be avoided, as this not only weakens the wheel, but tears off the corners, making it impossible to do good grinding without dressing the wheel until the corners are sharp. To get the best results from a grinding wheel, the corners should be kept sharp and the sides true.

If the spindle has a good bearing in the boxes, and the adjustment is neat enough so they warm up to about 110 deg. F. and a uniform belt is used, good results will be obtained even though the wheel is out of balance 1 oz. The nearer the wheel spindle is run metal to metal in its boxes the better will be the results.

Mr. Peckham states that a wheel should be rebalanced after each 1 in. of wear. This may be good practice but could not be done where production is an important factor as the loss in time would make it prohibitive. It does not require much time to balance a wheel if the wheel center is designed for this convenience, but when an operator gets going on production and stops to balance the wheel, it takes time to get the machine set for sizing again and the production going the same as when he stopped. My advice to an operator is, do not stop to rebalance the wheel after 1 in. has been worn away as long as the finish is all right.

At a large manufacturing plant I recently saw large rolls ground to a mirror finish without chatter and without the wheel being balanced. While I do not recommend grinding without balancing the wheel, yet at this particular plant they are getting satisfactory results. When they are troubled with chatter they immediately take up the wheel-spindle bearings and their trouble disappears.



WHEEL PROVIDED WITH BALANCING BLOCKS

For the past 25 years the Landis Tool Co. has had provisions in its wheel centers for balancing. As shown in the illustration, two cast-iron blocks are fitted in an annular groove in the wheel center, and can be clamped in any position around the groove. The balancing stand shown has rollers on which the balancing arbor is placed. These are supported by ball bearings, ground and balanced.

A Forecast for 1920

THE *American Machinist* has always endeavored to help solve the great problems, not only in its own particular field, but also those which affect the country as a whole and our manufacturing relations to foreign markets.

Shortly after the beginning of the World War it was foreseen that the United States might eventually be drawn in. It was also seen that in any event, our own and other manufacturers taking munition contracts would need all the help and information available. With this in view the editors got busy and gathered hundreds of articles from arsenals and shops of the United States, Canada and abroad, which were literally textbooks for many a contract holder. In Sydney, Australia, where only a few of the earlier munition articles were available, they were lithographed by the hundred and distributed to various contractors for British supplies by one of the principal manufacturers there. Other examples showing the value of the paper to this country and our allies could be given almost without limit. So important was the work of the *American Machinist* considered, that it was the *only* technical or other paper allowed to go to England *in bulk*—all editorial and advertising pages complete—during the most trying period of the war when every foot of space was considered in transporting our troops and supplies.

This war work is only a sample of what the paper does and is always ready to do for the upbuilding of industry and the good of humanity as a whole. A number of our war and subsequent activities are mentioned in the sketch of Major Van Deventer given last week, and need not be repeated here.

The coming year will present many problems quite as serious in their way, as the problems of the war period. We must work toward the adjustment of the great labor problems and endeavor to pave the way to real industrial peace and an understanding between employers and employees. These two should be a *team* and neither lag back on the traces and let the other pull all of the load. The pay envelope should not be scant, neither should the worker's individual time or production be scant. The old Golden Rule should still be kept polished and in plain sight of both sides. To assist in the solving of problems along this line, we are arranging for a series of signed editorials by men prominent in industry and known for their fairness and foresightedness in dealing with their employees. No merely theoretical stuff will be considered for a second, but actual, live discussion of the relations of employer and employee will be given a prominent place. No executives can afford to miss getting the views of men in their own field who have met and are solving the difficulties of the present unsettled conditions.

We shall aim to get even closer than ever to our readers in our weekly issues, and have planned an extensive program full of contributions written and arranged to be of the greatest good to the greatest number. As always, the paper will be liberally illustrated in the most attractive way we can devise.

A management series, which we believe will be the most comprehensive ever published by any magazine, is now well under way. Our welding series will be continued, and every phase of electric welding will be covered in the same comprehensive way as have Thermit and gas-torch welding. Several law experts will contribute articles on industrial relations, written along lines so well liked by a large number of our readers. We have secured the promise of a considerable number of new tool developments which will be published in the *American Machinist* two or three weeks ahead of any other publication in the field. Some of these articles are now in our office and will appear within a few weeks. These new tool major articles alone will be of inestimable value to many, as our advanced description will enable them to get in touch with the makers at the earliest possible moment—a thing very important considering the slowness of machine-tool deliveries at this time.

Another important thing is that with this issue we are adding eight more pages to the editorial section. This will enable us to get a greater amount of up-to-the-minute information to our readers and is a very tangible New-Year gift to each reader of the *American Machinist*.

Last week we announced to our readers the new line-up of the editorial staff of the American Machinist. In order to bring us all into closer personal touch with each other, we present this week pictures and brief sketches of the three new principal editors.

AFTER nearly fifteen years of machine-shop experience, accident made Ethan Viall an editor. While in charge of the shop of one of the largest builders of a special line of machinery in Chicago, he contracted a case of double pneumonia and typhoid fever. Chicago is no place for a man to stay in who has anything the matter with his lungs, so the doctor recommended a winter in Menomonie, Wis.—a place well inland and at that time absolutely guiltless of car lines or movies and as bare of other entertainment as Philadelphia on Sunday. In order to have something to do evenings, Mr. Viall turned to writing on mechanical subjects. His first short article appeared in the *American Machinist* in 1907 and his second article in *Machinery* a few weeks later. This encouraged him and he began to write in earnest, although he spent the year 1908 in a large shop in Decatur, Ill. In 1909 he became Associate Editor of *Machinery*. He held this position until Jan. 16, 1911, when he joined the staff of the *American Machinist* as Associate Editor. In 1913 he became Western Editor, with headquarters in Cincinnati. In March, 1917, he was called to the New York office as Managing Editor, which place he held until made [illegible].

Mr. Viall's shop experience has been wide and his nearly nine years' connection with the *American Machinist* has given him a large circle of acquaintances all over the United States. As a shop man he made a specialty of tools, dies and automatic machinery, and passed from machinist, toolmaker and foreman to superintendent and manager in several large shops. He is a native of Kalamazoo, Mich., and received his grammar and high-school education in Bloomington, Ill. Most of his shop and all of his technical school training was received in Chicago.

THE new managing editor, Kenneth H. Condit, pleads guilty to being over-educated, but has been trying to live it down ever since his last graduation—and especially since he joined the staff of the *American Machinist*.

He comes from New Jersey and got most of his training in Jersey institutions—Princeton University and Stevens Institute of Technology. Stevens turned him out as an embryo mechanical engineer in 1908 and Princeton gave him the degree of civil engineer in 1913. For three years between these two dates, he served as draftsman and testing engineer with Safety Car Heating and Lighting Co., and as assistant manager A. G. Spalding & Brothers, at their Newark salesroom and shop.

At the conclusion of his studies at Princeton, Mr. Condit was appointed instructor in civil engineering, a position which he held until the outbreak of the war. In May, 1917, he was given leave of absence to go to Toronto with two other members of the Princeton faculty to secure the information necessary for the organization of the U. S. School of Military Aeronautics at Princeton. He was commissioned first lieutenant July 5, 1917, and given charge of the work in airplane engines at this school for fourteen months. He was promoted to a captaincy and transferred to the Motor Liaison Division of the Air Service at Wilbur Wright Field. He remained at this post until discharged shortly after the signing of the armistice.

Mr. Condit joined the editorial staff of the *American Machinist* early in January, 1919.

THE other editor, Fred H. Colvin, was known to the readers of the *American Machinist* for many years before he became actively identified with the editorial staff in January, 1907. Away back in his apprentice days, he began writing for the *American Machinist*, his first contribution appearing in the issue of April 3, 1886, in the Department of Letters from Practical Men. Other letters and articles followed, and, though not directly connected with the paper until 1907, he was well acquainted with almost all of the former editors of the paper.

Going into the shop at the age of fifteen gave no time for any schooling but the advanced grammar grades, so that night schools, after a ten-hour work day, provided the only method of studying mechanical drawing, physics and other fundamentals. It is probably because of this lack of opportunity on his own part that much of his writings, especially his books, has been directed toward making these fundamentals clear to others similarly situated.

His editorial experience began with the first issue of *Machinery* in September, 1894. Leaving this in June, 1897, he became Associate Editor and Business Manager of *Locomotive Engineering*, which had been started by John A. Hill, in January, 1888, under the auspices of the *American Machinist*. Following a man like John A. Hill is no easy matter, and, as Mr. Colvin frequently expresses it, he "wabbled around in John Hill's shoes for five years."

All this previous experience laid a solid foundation for his work on the *American Machinist*, and there are comparatively few machine shops, even in out-of-the-way places where he is not known, either personally or through his writings in the *American Machinist*, or his books.

How to Get Machine Tools Available Under the Provisions of the Caldwell Bill

WITH this announcement the *American Machinist* finishes the strenuous campaign which was begun just a year ago to make surplus machine tools available for educational purposes. Vexatious delays have occurred and the final form of the bill differs in some respects from that of the one advocated in these columns. The main thing is, however, that the tools are now available. The remaining steps in the securing of them must be taken by the directors of the institutions desiring them.

The information that follows is primarily for the trade schools and technical institutions of the country. However, others interested in the disposal of the surplus material in the possession of the War Department will do well to note the provisions under which the schools may purchase their share of them.

The details of procedure as laid down by the authorities at Washington have just reached us and are printed in full for the information of those concerned.

Procedure for the Sale of Machine Tools

1. Inquiries—All inquiries pertaining to the above subject should be addressed to the Director of Sales, Munitions Building, Washington, D. C., who will act in coördinating this work. Selling bureaus and district offices will forward any such inquiries received by them to the Director of Sales.

2. Replies (Sending of Questionnaires)—The Director of Sales, upon receipt of an inquiry for machine tools from any educational institution, will reply direct by letter and inclose three copies of questionnaire which will be filled out by the institution and two copies returned to the Director of Sales.

3. Statement of Requirements and Filling Out of Questionnaire—The educational institution will fill out the questionnaire and on a separate sheet will state as nearly as possible what machine tools it requires. The questionnaire will be returned, in duplicate, to the Director of Sales properly certified.

4. Recording and Approval of Questionnaires — These questionnaires will be considered in the order in which they are received by the Director of Sales, who will pass upon the institution's eligibility under this act.

5. Notifying the Institution of Its Eligibility — If found eligible, the Director of Sales will forward to the institution notice of such decision, and as many purchasing coupons as that particular school will be entitled to. It will also advise the bureaus and district offices, through proper channels, to place the institution on their bulletin mailing lists and to forward at once their latest bulletins of machine tools.

6. Use of Coupons—The institutions will then be able to select from the bulletins such machine tools as they are entitled to purchase and will negotiate with the district office in the matter of obtaining the tools. No preference will be shown either commercial customers or educational institutions. In view of the fact that there are but a limited number of machine tools suitable for the use of educational institutions, an institution will be given ten (10) days after the date of receipt by the district office of notice from such institution that it desires to purchase a certain tool, in which to consummate such purchase. If the tool has not been previously sold, the district office will so advise the institution. The institution will then forward to the district office its order together with shipping instructions, certified check in full and a coupon for each machine tool desired, upon receipt of which authority will be issued to ship the machine, the institution paying all freight and transportation charges. This transaction will be considered as a sale by the district office and reported in the customary manner, but on a special form provided for that purpose.

7. Machine tools shown in these bulletins are described according to the best information obtainable, but the United States does not guarantee the accuracy of these descriptions or warrant the condition and fitness of such machine tools or their suitability for the use intended to be made of same. Arrangements can be made to examine these tools, by application to the district office where the tool is located.

8. Sale of machine tools under the provisions of the act of Congress shall not be made except in accordance with the above instructions.

The Questionnaire

For educational institutions desiring to purchase machine tools from the United States Government at 15 per cent of the cost to the Government as provided by the following act of Congress:

1. Act, approved Nov. 19, 1919, authorizing Secretary of War to sell machine tools to educational institutions at 15 per cent of cost:

That the Secretary of War be, and he is hereby, authorized under such regulations as he may prescribe, to sell at 15 per centum of their cost to trade, technical, and public schools and universities, and other recognized educational institutions, upon application in writing, such machine tools as are suitable for their use which are now owned by the United States of America and are under the control of the War Department and not needed for Government purposes. The money realized from the sale may be used by the Secretary of War to defray expenses, except cost of transportation, incident to distribution of the tools, and the balance shall be turned into the Treasury of the United States as miscellaneous receipts; Provided, That in the event any such material is offered for sale by said institutions without the consent in writing of the Secretary of War, title thereto shall revert to the United States.

2. When completely filled out, return this form in duplicate to the Director of Sales, Munitions Building, Washington, D. C. One copy will be retained by the educational institution.

3. These questionnaires will be considered in the order received by the Director of Sales. When an institution has presented satisfactory evidence of eligibility, the various district offices will at once be advised and the Director of Sales will forward to the institution numbered coupons covering the number of machine tools that the institution will be allowed to purchase. One coupon for each machine tool desired, together with certified check and shipping instructions, must accompany each purchase order. Each tool purchase must be handled as a separate transaction and individual certified checks must be furnished covering each tool purchased.

4. The following list of district offices will receive orders for machine tools:

Air Service

Buffalo, 2050 Elmwood Ave., Buffalo, N. Y.
Chicago, Army Building, 230 E. Ohio St., Chicago, Ill.
Dayton, care Maxwell Motor Co., East 1st St. and B. & O. R.R., Dayton, Ohio
Detroit, care Aviation General Supply Depot, Springwells, Detroit, Mich.
New York, 360 Madison Ave., New York City
San Francisco, Postal Telegraph Bldg., San Francisco, Cal.

Ordnance

Baltimore, Columbia Ave. and B. & O. R.R., Baltimore, Md.
Boston, 19 Portland St., Boston, Mass.
Bridgeport, 945 Main St., Bridgeport, Conn.
Chicago, 74th St. and South Ashland Ave., Chicago, Ill.
Cincinnati, Walsh Bldg., 3d and Vine Sts., Cincinnnati, Ohio
Cleveland, 22d and Prospect Ave., Cleveland, Ohio
Detroit, 35 Washington Blvd., Detroit, Mich.
New York, 1107 Broadway, New York City
Philadelphia, 1710 Market St., Philadelphia, Pa.
Pittsburgh, 40th and Butler Sts., Pittsburgh, Pa.
Rochester, 1048 University Ave., Rochester, N. Y.
St. Louis, Mo. State Life Bldg., St. Louis, Mo.
Toronto, Room 21, 43 Victoria St., Toronto, Canada

M. & E. M. Surplus Property, Zone Supply, P. S. & T.

Atlanta, Transportation Bldg., Atlanta, Ga.
Baltimore, Coca-Cola Bldg., Baltimore, Md.
Boston, 108 Massachusetts Ave., Boston, Mass.
Chicago, 1819 W. 39th St., Chicago, Ill.
Jeffersonville, Jeffersonville, Ind.
New York, 461 8th St., New York City

New Orleans, Audobon Bldg., New Orleans, La.
Omaha, Omaha, Nebraska
Philadelphia, 21st and Oregon Ave., Philadelphia, Pa.
St. Louis, 2d and Arsenal Sts., St. Louis, Mo.
San Francisco, Ft. Mason, San Francisco, Cal.
Texas, San Antonio, Texas
Texas, El Paso, Texas

SIGNAL CORPS

Boston, Textile Bldg., Boston, Mass.
Chicago, Army Bldg., 230 E. Ohio St., Chicago, Ill.
New York, 8-10 Bridge St., New York City

5. Bulletins, describing available machine tools, are published by the above district offices; the educational institutions will receive these bulletins and selections will be made from same. All negotiations will be carried on between the institution and these district offices. Machine tools shown in these bulletins are described according to the best information obtainable, but the United States does not guarantee the accuracy of these descriptions, or warrant the condition and fitness of such machine tools or their suitability for the use intended to be made of them. Arrangements can be made to examine these tools by application to the district office where the tool is located.

6. The price of machine tools will be 15 per cent of the cost to the United States. Terms: Certified check in full with order. Tools will be placed by the United States on cars at point where same are located, the institution paying all freight charges. Title to the machine tools will pass when so loaded. All machine tools are subject to prior sale. When the institution receives notice from the district office that the tool is available, it will forward its order, shipping instructions, certified check in full and one coupon.

7. Sales to educational institutions have no priority over commercial sales. Where several accredited institutions ask for the same tool, the district office will accept the first letter or telegram received. After such acceptance the machine tool will be held for ten days to enable the institution to complete negotiations and to deliver to the district office its order, shipping instructions, certified check and coupon, although the Government assumes no liability for a failure to do so.

8. Please answer the following questions fully:

a. Name of institution:

b. Address:

c. When founded:

d. Kind of school — state university, college or other school state school and land grant school combined, land grant school only, privately owned school, municipal, trade or other school, etc.:

e. President or principal officer:

f. Names of officers of institution who will be delegated to transact business with the Government:

g. Has your institution been legally recognized by the Federal, state or municipal board of education? (Yes or No): If so, attach copy of this recognition, such as an annual educational report. Also attach a copy of your last catalog.

h. Did your institution give special training for military purposes or otherwise from 1913 to 1919? (Yes or No): If so, attach letter describing courses, length, and average number of students attending. (Civilian and enlisted.)

i. Does your institution receive Federal, state or municipal aid? (Yes or No): State by attached letter nature and amount.

j. Have you made previous application for, or received any machine tools from the U. S. Government? (Yes or No): If so, attach letter showing under what authority such tools were obtained.

k. Total valuation of your institution: $ Total valuation of buildings and equipment devoted to engineering, vocational or manual training: $ Acreage: Number of buildings: Present indebtedness: $ Endowments: $ Tuition fee: $

l. Present number of students—resident: non-resident: Total: Number of students enrolled in engineering, vocational or manual training courses: Number of students given shop work at same period in engineering, vocational and manual training courses: Floor area in square feet of shops devoted to engineering, vocational or manual training courses:

NOTE—Machine tools now installed in your shops should be carefully listed on separate sheet and attached hereto, together with condition and approximate age.

Attached hereto a list describing approximately the style and size of machine tools desired.

Total number of machine tools hereby requested:

Reasons for which additional equipment is desired should be clearly stated by letter attached hereto.

I hereby certify that the machine tools requested above are to be used for educational purposes only, and will not be resold without the written consent of the Secretary of War and that all the above statements are true.

Name: Title:

Approved by postmaster or other Federal official:

Name: Title: Date:

What Is Doing in Europe?

BY R. SANFORD RILEY
President, Sanford Riley Stoker Co.

We may well be disturbed over the industrial unrest now prevailing, but to one returning from a trip abroad there is an appearance of stability and happiness in this country that is very wholesome. Supplies of almost every nature are available; our buildings and equipment generally are well kept up; we have the most improved labor-saving machinery and in every way it looks a good place to live.

IN GREAT BRITAIN there are hopeful signs of a return to better conditions. With the great reaction from the self-sacrifice and coöperation demanded by the war there has been an outbreak of selfishness and disorder that is, perhaps, only the natural swing of the pendulum. A new idea of the value of labor-saving devices is one of the hopeful results of a scarcity of labor. Britishers formerly had little incentive to save labor because labor was not sufficiently costly to them. Now that they are obliged to pay a high price for labor they realize the advantage of American labor-saving machinery and the result is a desire to adopt our methods and equipment in order to give them an equal chance in the world's trade. This for the time being will result in a good business for American machinery

The labor unions of Great Britain have sometimes been opposed to labor-saving devices, but it now seems that even the most backward of these unions must realize that such machinery is essential for their own well being. Britain must always depend on trade with the outside world; therefore she must adopt some of the methods so highly developed in America. The public men of England are preaching the need of greater individual production, and they are being listened to now as they never were before.

In France and Belgium there is a great effort being made to renew the productive machinery. Many American firms have big contracts for replacing destroyed machinery. I saw many train loads of machine tools and other equipment on its way back to France and Belgium from Germany. I was interested to note that the occupied portions of Belgium were injured very little and the people were recovering quickly. Many of these people are now disclosing resources which the Germans

would have been glad to know about. The attitude of the Belgians toward their captors was naturally hostile and had rather a demoralizing effect from an ethical point of view.

The coal shortage was very marked and in Lens I saw something of the cause of this. The ruined mines there give a terrible impression of wanton destruction by the Germans. In that section alone there were 20 mines averaging about 1000 employees each, all ruined so they cannot produce coal for years to come.

In Germany I was impressed most of all with the purchasing power of an American dollar. Although their prices have been advanced in their own coinage, the rate of exchange was so favorable to the American dollar that the commodities actually appeared cheap to me. This purchasing power of the dollar is a great economic fact and will have its effect in the world's commerce.

Before arriving in Germany I had read many editorials and articles which might make one doubtful as to who won the war. In Germany, however, they know. From the highest to the lowest they realize that they have been defeated absolutely and completely. Of course, they will recover because they have a great capacity to work and all they need is something to work on. Their coal supply is very precarious. In fact, I was told that the best they could hope for is 30 per cent. of their normal needs.

This knowledge of defeat in Germany may be quite an influence in getting the people settled down to work again under peace conditions. They can attribute all the present troubles and high cost of living to this defeat and thus perhaps accept their lot more philosophically, whereas in the allied countries we may be subconsciously looking for the fruits of victory, and may be correspondingly irritated because there are none. We have no such "goat" on which to blame our troubles.

In connection with our efforts to expand our foreign trade and help the world get on its feet again we must remember that trade cannot always flow one way. For the past five years we have been sending commodities and receiving money or securities. We still have plenty of commodities to send, but under present conditions Europe has very little money to give us in return. If we would continue selling we must look about for opportunities of buying. France and England are beginning to realize that they must trade with Germany in order to get the indemnity imposed upon Germany. Our Ambassador in London, the Hon. John W. Davis, pointed out to me very forcibly that the commercial isolation of Germany is no more sound than the old idea of imprisonment for debt. It might be well for our merchants and manufacturers to think more along this line and see what we can do to establish a counter-current of trade that will build up all these European countries that have been unable to sell and have, therefore, nearly reached the limit of their buying capacity. For the good of the world the great currents of trade must be reëstablished in both directions.

With the return of machinery from Germany to France and Belgium, it is interesting to note that the commissions who have charge of this work found a remarkable collection of records. They found that every kind of equipment that was removed was carefully card catalogued, showing where it came from and where it went to. The owners of such machinery have been able to locate it without much difficulty, and it is being brought back to them. Some of it, of course, has been abused and badly worn, so that extensive repairs will be necessary.

My visit to Germany was mainly in the interest of the Norton Co., as one of its directors. We have had a plant at Wessling, near Cologne, since 1910, and were most interested to know what it looked like after the war. I found it about twice the size it was before the war and in good running order. Of course, it had a good deal of "ersatz" (the German word for substitute) such as paper belts instead of leather, etc. It was nevertheless turning out grinding wheels to the best of its ability with the poor quality of raw material available.

To offset the doubling of the plant, there was, of course, a corresponding debt, but it takes very little American money to pay off this debt. In fact, it is astonishing how much brick, mortar, and equipment we can buy with American dollars at this time. It seems to have been the policy of the Germans not to take over any such American-owned plants. We understood during the war that all plants had been "sequestered," but it was turned back to us, apparently on the theory that it was good business to have American capital remain invested in Germany.

In general I found the greatest interest in all such labor-saving machinery, both in machine shops and power plants. I believe we are going to see human labor valued and conserved as it never has been before in Europe.

A Tool for Measuring Angles

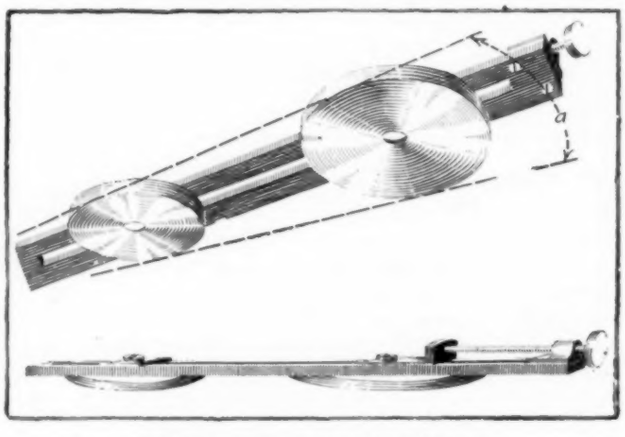
By Carl F. Mathisen

The instrument shown in the illustration can be used for laying out and measuring angles and if carefully made, with the measuring disks hardened, ground, and lapped, extreme accuracy may be obtained. It is more useful than the sine bar, as it can be used in cases that, with the latter, would be difficult or impossible. With four or five disks of various sizes almost any angle can be measured.

The setscrew is not absolutely necessary but conduces to the facility with which the tool may be set.

The principle is as follows: Let the diameter of the large disk be D; of the small disk, d; and the distance between their centers L. Then:

$$\text{Sin } \tfrac{1}{2}a = \frac{D - d}{2L}$$



TOOL FOR MEASURING ANGLES

SHOP EQUIPMENT NEWS

-Edited By-
E. L. DUNN and S. A. HAND

SHOP EQUIPMENT • NEWS •
A weekly review of modern designs and equipment

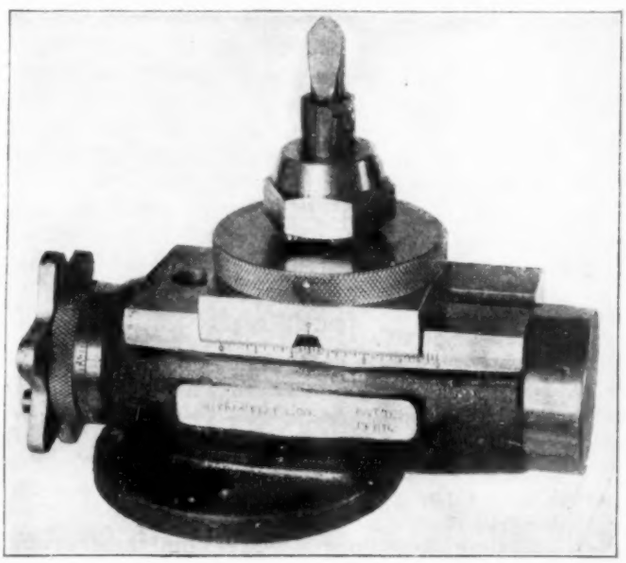
Descriptions of shop equipment in this section constitute editorial service for which there is no charge. To be eligible for presentation, the article must not have been on the market more than six months and must not have been advertised in this or any previous issue. Owing to the news character of these descriptions it will be impossible to submit them to the manufacturer for approval.

• CONDENSED • CLIPPING INDEX
A continuous record of modern designs and equipment

Ayre Micrometer Facing and Boring Machine

W. W. Ayre, 303 Fifth Ave., New York, is putting on the market a micrometer facing and boring head as illustrated herewith. This tool is intended for use on either a boring, milling, or drilling machine, or a turret lathe.

The cutting tool has a round shank and is held in a split chuck. The feed is by the usual star wheel and



AYRE MICROMETER FACING AND BORING HEAD

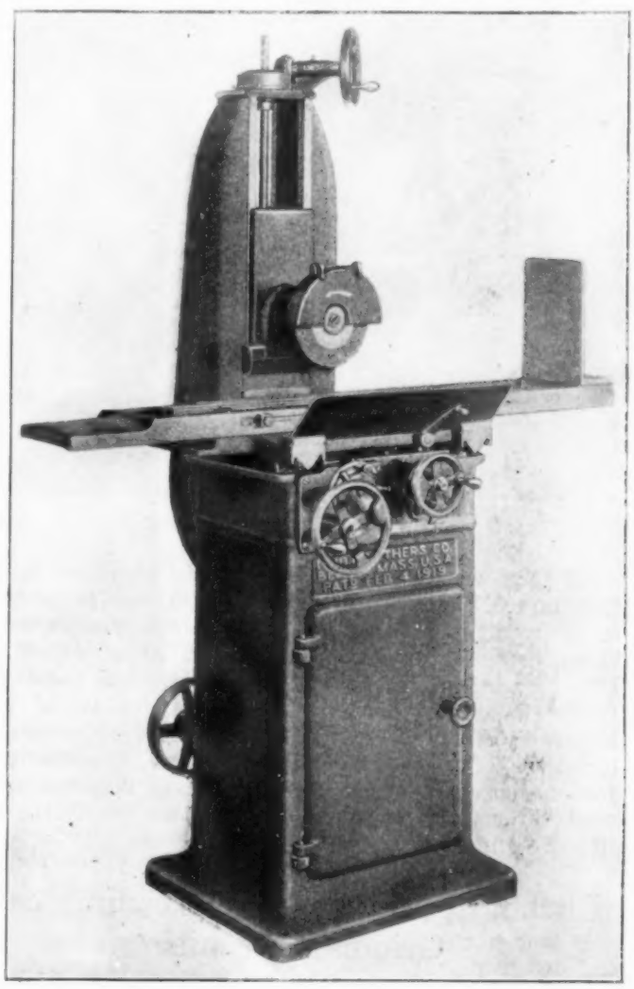
the screw is provided with a micrometer collar divided in thousandths of an inch. The main slide is graduated in inches and sixteenths and the amount the tool is off center can be seen by reference to the zero line on the tool block. The capacity for facing or boring is 6½ inches.

Reid No. 2 Surface Grinding Machine

The improved model No. 2 surface grinding machine manufactured by Reid Brothers Co., Inc., Beverly, Mass., has made its appearance in the market. The design shows that every precaution has been taken to prevent abrasive dust coming in contact with any wearing surface, a point that is prominent in the arrangement of the head.

The head is accurately fitted to the back column, its movement being controlled by the vertical screw.

It is, therefore, important that there should be no accumulation of dust and grit on the ways. As a protective measure in this respect the machine is equipped with a compact spring curtain to keep out dust and dirt. As a further prevention against flying grit, etc., guards at the side and end of the table are provided, and a substantial guard is also used to cover the wheel. The spindle is hardened, ground and lapped,



REID NO. 2 SURFACING GRINDING MACHINE

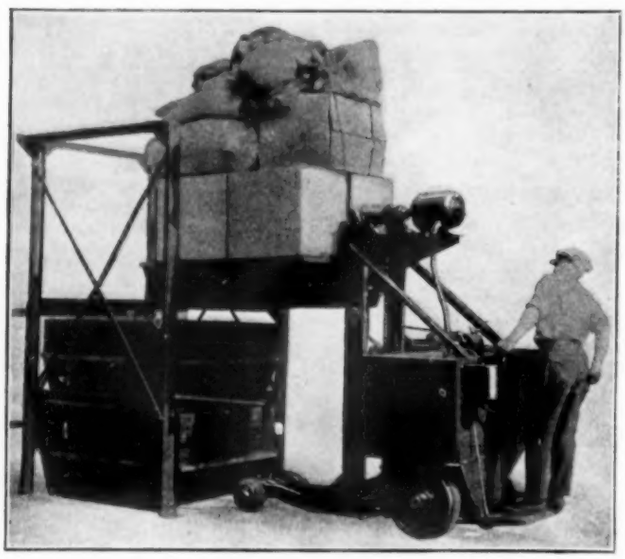
Specifications: Machine will grind work 18 in. long, 6 in. wide, and 11¼ in. high. The table has three T-slots and is 46 x 8 in. in size; working surface, 18 x 6 in.; size of wheel, 7 x ½ in. with 1¼-in. hole; countershaft, tight and loose, pulleys, 8 in. in diameter for 3-in. belt; speed, 360 r.p.m.; floor space of machine 65 x 30 in.; net weight, 1050 lb.; boxed for export, 1250 lb.; cubic feet of box, 48. Equipment furnished with machine; diamond-holder fixture, one wheel, wrenches and overhead works.

and runs in phosphor-bronze bearings adjustable for wear. Vertical adjustments are obtained by a hand-wheel graduated to one-half thousandth of an inch. The table travel is automatic in both directions, and is controlled by dogs operating against the reverse lever, which can be disengaged to permit movement of the table beyond the reversing point without changing dogs.

Quick starting and stopping of the longitudinal feed is accomplished by a centralized control in the hand-wheel shaft. The crossfeed is automatic in both directions, with a range of 0.007 in. to 0.084 in. feed at each reverse of the table. By a slight movement of an adjusting screw all the automatic crossfeed mechanism may be disengaged to permit the use of the hand feed.

Lakewood Tier-Lift Truck

The Lakewood Engineering Co., Cleveland, Ohio, has placed on the market a carrying and lifting truck as shown in the accompanying illustration. It is claimed for this truck that it will perform all the functions of a tiering machine as well as those of a load carrying truck.



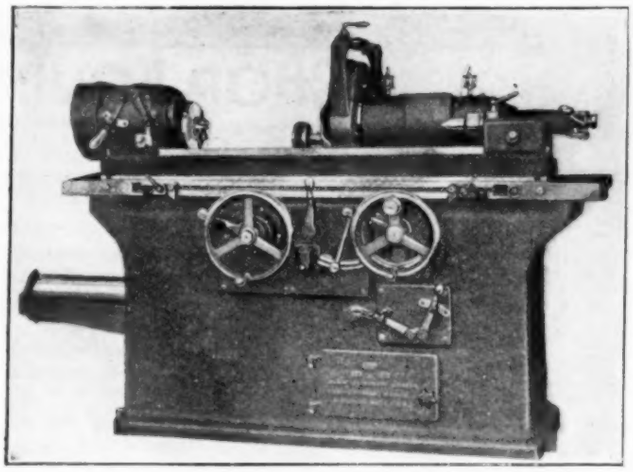
LAKEWOOD TIER-LIFT TRUCK

All four wheels are used in steering and it is said that the truck can turn in a radius of 92 in. The power is by storage batteries and motors, separate motors being used for traction and lifting. Three speeds, both forward and backward, are provided and the controller handle is conveniently located for travel in either direction. The lifting mechanism is operated by means of a specially designed controller providing for one speed in either direction. Ball bearings are used throughout. The capacity is two tons with a lift of 76 inches.

Fitchburg 8 x 36-In. Plain Cylindrical Grinding Machine

The Fitchburg Grinding Machine Co., Fitchburg, Mass., has placed on the market a line of plain cylindrical grinding machines, one size of which, the 8 x 36-in., is shown in the illustration.

The wheel spindle is made of tool steel and runs in bronze bearings, adjustment being provided for wear. The automatic crossfeed is operated at each reversal



FITCHBURG CYLINDRICAL GRINDING MACHINE

The specifications of the 4 x 36-in. machine are: Capacity, 8 in. diameter, 36 in. length; table will swivel 7 deg.; work centers, No. 4 Morse taper; wheel spindle, front bearing 3 x 7⅛ in., rear bearing 2¼ x 6½ in.; grinding-wheel pulley, 6 x 4⅛ in.; grinding wheel, diameter 16 in., face 1 in. to 3 in., hole 5 in.; speeds, grinding wheel (2) 1400 to 1640 r.p.m., work (6) 64 to 340 r.p.m.; table feeds (6), 28 to 150 in. per minute; tight and loose pulleys on countershaft, 700 r.p.m.; floor space, right angle to spindle 52 in., parallel to spindle 115 in.; weight, net, 4600 pounds.

of the table and may be set to be self-releasing when the work has been ground to size. The table swivels on a central stud and can be set to grind tapers. The reversing mechanism is said to be positive and accurate. The coolant tank is cast in the bed and the pump is of the fan type. The work rest has fine adjustment and is provided with adjustable set collars for maintaining the size of the work.

The regular equipment includes a center grinding attachment and a wheel-truing device. This machine is built in six sizes ranging from 4x36 in. to 12x54 inches.

Statistics Show That Accidents Have Declined in the Steel Industries

The Bureau of Labor Statistics has completed a new study of the accident rates in the iron and steel industry, based particularly on a comparison of the five-year period before the war (1910-1914) and the war-time period (1915-1918).

Considering the unit as a whole, both the frequency and severity were less in the war period than in the pre-war period. A closer study of the figures reveals that the 1910 high-water mark was so much above any of the succeeding years that it alone was sufficient to account for much of the discrepancy. The frequency rate declined from 177.7 cases per thousand 300-day workers to 129.6 cases in the war period. The severity rate declined from 12.3 per worker to 10.9. In 1910 the figures covered 202,153 300-day workers of whom 3,273 were killed, 848 were permanently disabled—with an average disability per worker of 15.9 days.

In the first year of the war period, 1915, the total number of workers slumped to 116,224, with 87 deaths, 372 permanent disabilities and 13,481 temporary disabilities, and making a low-water mark of 119.9 disabilities per thousand workers and a disability record of 8.1 days lost per worker. In 1918 the industry had reached its high-water mark of employment, with 455,-360 workers; 496 deaths; 1209 permanent disabilities and 52,896 temporary disabilities with a disability loss per worker of 10.6 days.—*Iron Age.*

Restriction of Trade in Patent Agreements

By E. H. Michaelis
Consulting Engineer

Under the above heading Chesla C. Sherlock writes an article in which he states that a patentee would find "the bottom dropping out of any elaborate system of selling and price fixing he may establish" because the Federal courts have taken a view of the rights of the patentee in regard to the setting of resale price and restricting the use of the patented machine or article, which would not stand, if taken into the Supreme Court.

This question is no doubt one of the most interesting in connection with the patent law, and therefore I take the liberty to call attention to the case "Dick versus Henry" which was taken to the Supreme Court of the United States. This case has probably occasioned more discussion at the bar, in the press and before Congressional committees than any other one. The decision of the court is set forth at such length, that it is impossible to quote it in full.

The action was taken by the A. B. Dick Co. as complainants for the infringement of two letters patent covering the rotary mimeograph.

All such machines were sold by the patentees under license which was attached to every machine and read as follows: "This machine is sold by the A. B. Dick Co. with the license restriction that it may be used only with the stencil, paper, ink and other supplies made by the A. B. Dick Co., Chicago, U. S. A."

Sidney Henry, the defendant, sold to an owner of a rotary mineograph some ink to be used in connection with this machine, knowing of the license restriction. This ink was not covered by the claims of the patent. The A. B. Dick Co. claimed that this was an infringement on their patent rights. The defendant contested this view, stating no patent law case but a general law case was in question, because the license restriction under which the owner of the machine bought it and by buying acknowledged as binding, was no part of the rights granted to the patentees by the letters patent issued to them.

The Court says in one place in its decision: "The books abound with cases upholding the right of a patentee owner of a machine to license another to use it subject to any qualification in respect to time, place, manner or purpose of use which the licensee agrees to accept. Any use in excess of the license would obviously be an infringement and the license would be no defense." Further on it says: "Is it true, that, where a patentee sells his patented machine for a specific and limited use, he does not thereby reserve to himself, as patentee, the exclusive right to all unpermitted uses, which may be made of his invention as embodied in the machine sold? Obviously, this is a question arising under patent law." And still further: "Of course the argument does not mean, that the effect of such condition is to cause things to become patented which were not so without the requirement (the license restriction). The stencil, the paper, and the ink made by the patentee will continue to be unpatented. Any one will be free to make, sell and use them and like articles as they would be without this restriction, save in one particular, namely they may not be sold to a user of one of the patentee's machines with intent, that they shall be used in violation of the license." The following quotation from the decision of the Court sets forth the main issue: "This larger right (the right to keep others entirely from using the patented article) embraces the lesser of permitting others to use upon such terms as the patentee chooses to prescribe."

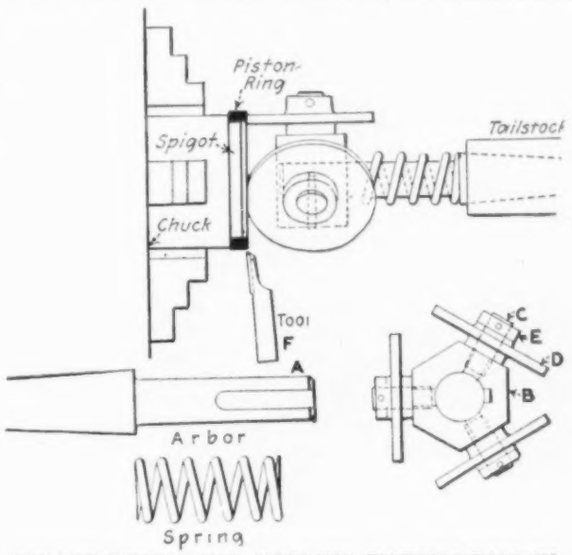
In conclusion I will mention that this decision of the Supreme Court was arrived at by a vote of six to three and that it was criticized very strongly in the press and at the bar. It stands, however, today as the law of the United States.

Holding Piston Rings for Sizing Them

By Stewart Reid
Brisbane, Australia

I have a small plant here in Brisbane for the manufacture of marine motors, wherein many difficulties have to be faced by reason of the lack of suitable equipment. The following is a description of a tool which we use to get the faces of piston rings parallel and of the right thickness, and, at the same time, leave a good finish.

After going through the usual operations of turning and boring, the rings are parted off, leaving from 0.005 to 0.012 in. for finishing. Then they are located on the



UNIQUE DEVICE FOR HOLDING PISTON RINGS IN THE LATHE

spigot, which is held in the lathe chuck and the tool is held in the tail spindle by which it is brought into contact with the side of the rings. A strong spring back of the body of the tool keeps the rollers pressing hard on the side of the ring during the cut.

The tool consists of an arbor *A*, one end of which is made to fit the tail spindle and the other end turned parallel to fit the body *B*, which latter is made out of any suitable piece of hexagon steel. A key between the body and the arbor prevents the tool from revolving. The body is drilled and tapped to take the pins *C*, upon which revolve the three disk rollers *D*. The rollers are held on by collars *E* which are held to the pins *C* by cotters.

After cleaning up one side of a lot of rings, the facing tool *F* is set to the right position to bring the rings to the required thickness, when the operation is finished.

I have found this tool a time saver, and at the same time we get interchangeable rings.

Sparks from the World's

By E. C. Porter,

Ten Phone Messages Go On Wire at Once

Experiments are being conducted by Major-General George O. Squier, chief signal officer of the army, and other experts which will prove the commercial practicability of sending ten or more messages simultaneously along one telephone wire for exceedingly long distances.

Tests on the method were made by Major-General Squier last year between Baltimore and Washington, and the American Telephone and Telegraph Co. had engineers working last May on a line between Baltimore and Pittsburgh. Experiments also have been made on the same line by Dr. Lee De Forest, inventor of the Audion bulb, between Toronto and Hamilton, Canada.

Briefly, the method of transmission consists of passing a direct current modulated by a microphone through an Audion detecter, which transforms it into a high frequency current which may have 1,000,000 or more cycles a second. This current then will follow a wire, not actually passing through it, but traveling in the direction of the wire through the ether. It is possible for ten and probably many more currents to use the same wire at the same time as their guide, and the distance they may travel in this way is said to be practically unlimited. The expense of ordinary telephony between New York and San Francisco is heavy because only one conversation may be carried on over the wire, but under the new system this one circuit will be available for a number of other conversations without interfering with the ordinary method of telephoning.

National Efficiency Society Appoints Executive Secretary

The National Efficiency Society at the meeting of its board of governors held on Tuesday, Dec. 23, appointed H. F. J. Porter its executive secretary. Mr. Porter was the founder and executive secretary of the Efficiency Society in 1912 and resigned in 1914 to return to his industrial engineering practice. In 1918 the Efficiency Society and the National Institute of Efficiency united under the name of the National Efficiency Society with headquarters at 119 West 40th St., New York.

The society believes that the recent movement toward closer co-operation between employer and employee in industry, through shop committees on which the employee is represented in the management, is the logical step toward higher productive efficiency in industry now so desperately needed, and has turned to the pioneer in this movement, Mr. Porter, who first introduced a shop committee in this country in 1903 and who has been identified with the movement ever since.

In the *American Machinist* for Sept. 28, 1905, Mr. Porter described fully in an article entitled "The 'Get-Together' Principle in a Factory Organization," the establishment of his first shop committee in the plant of the Nernst Lamp Co., a Westinghouse interest in Pittsburgh, Pa.

This was the beginning of a movement which now promises to be the leading one in establishing better relations between the antagonistic elements in the industrial field.

Acknowledgment of Season's Greetings

The *American Machinist* takes this means of acknowledging the receipt of Christmas cards from the following concerns, and extends to them its heartiest wishes for continued prosperity during the new year: Bullard Machine Tool Co., Moline Tool Co., Morse Chain Co., Hudson Motor Car Co., Cincinnati Planer Co., Henry & Wright Manufacturing Co., Cochrane-Bly Co., La Salle Tool Co., Chas. A. Schieren Co., Allied Machinery Co. of America, Seneca Falls Manufacturing Co. Inc., Norma Co. of America, E. Isbecque & Co., K-G Welding and Cutting Co. Inc., Wicaco Screw and Machine Works Inc., Chas. A. Strelinger Co., Union Twist Drill Co., Heald Machine Co., R. S. Stokvis & Zonen, Ltd.

New Officers for the Western Society of Engineers

The nominating committee appointed by the Western Society of Engineers has nominated the following men to serve as officers for the ensuing year: President, F. K. Copeland; first vice president, C. F. W. Felt; second vice president, J. L. Hecht; third vice president, Linn White; treasurer, S. F. Fowle; trustee for three years, J. H. Libberton.

The Western Society of Engineers has just finished an extensive campaign for new members which has resulted in increasing the membership 175 per cent or approximately 2,100 new members. The purpose of this membership campaign has been to build up a strong engineering society in the West which would be of sufficient strength to be of national importance.

Society of Automotive Engineers To Hold Annual Meeting

The annual meeting of the Society of Automotive Engineers, Inc., will be held in the Auditorium, Engineering Societies Building, 29 West 39th St., New York City, on Jan. 6 to 8, 1920.

On Jan. 6 the fifteen divisions of the standards committee will present reports of their recommendations for discussion and acceptance. The business session will begin at 10 a.m. on Jan. 7, and will be followed at 11:30 by a symposium on Needs and Tendencies of Engine Design; luncheon at 1 p.m. Beginning at 2 p.m. a number of papers will be presented on the subjects of Aluminum Pistons, Automotive Steam System, Automobile Body Design, Springs and Spring Suspensions, and the Measurement of Vehicle Vibrations. A carnival will be held in the North Ballroom, Hotel Astor, at 9 o'clock.

The Fuel and Research session will be held on Jan. 8 in the morning and afternoon with intermission for luncheon at 1 p.m. The 1920 S. A. E. dinner will be held in the Grand Ballroom of the Hotel Astor at 9 o'clock.

All-Electric Steel Mill to Be Constructed in Ohio

A company to operate the first all-electric steel mill in the country, construction of which is to be begun in February on a site between Girard and Warren, Youngstown, Ohio, has been incorporated at $1,500,000. L. J. Campbell, vice president of the Youngstown Sheet and Tube Co., has resigned to take charge of the new mill.

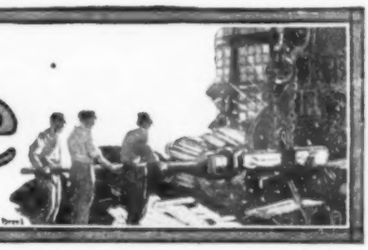
The plant, which is to be the base of a larger plant later, will have two electric smelters and 10- and 16-in. rolling mills. It will make the finer grades of steel, vanadium, chrome and nickel steel for use in automobile parts, locomotive parts and cutlery. It will employ 500 men at the start.

Firth-Sterling Steel Company Moves to New Quarters

The New England headquarters of the Firth-Sterling Steel Co., which has been located at 35 Oliver St., Boston, Mass., for a great many years, will move during January into its new warehouse at 85-91 West First St., South Boston, where a stock of blue chip, high-speed tool and die steels will be carried. The property being vacated by the Firth-Sterling Co. has been purchased by the Federal Reserve Bank as a site for its building.

Industrial Forge

News Editor



Directions for Boxing Machine Tools for Export Shipment

These directions for boxing machinery apply to orders placed by Construction Metallique, Belgium, for shipment to Antwerp.

They are intended to cover the subject in a general way only, and no attempt has been made to specify the form or overall dimensions of the frame of any case or the number or location of blocking pieces or stay braces between parts of machine or between the inclosing case and the machine proper which will be required to prevent movement of the machine or its parts within the completed case.

Well-Seasoned Lumber Must Be Used for Packing

The lumber for cases and skids must be well-seasoned spruce, or yellow pine, sound and free from large, loose or rotten knots, or any other defects that would impair it for the service intended; merchantable grade lumber will be satisfactory. Lumber for bottoms, tops, sides and ends must be tongued and grooved 1¼-in. stock, except as otherwise stated.

Where the base of the machine or the machine itself does not exceed 450 to 500 lb. in weight, the floor of the case may be made of 1¼-in. stock lumber; where the base of the machine or the machine itself exceeds 450 to 500 lb. in weight, the floor of the case is to be made of 2-in. stock lumber.

Two or more skids composed of 2 x 3-in. or 3 x 4-in. lumber must be supplied whenever the gross weight of the case and contents exceed 350 lb., and must be formed at each end so as to permit of easy moving on pipe rollers. Heavier skids must be supplied according to variance in weight.

Framing lumber 1¼ x 3 in. or 2¼ x 4 in. must be used in the interior of the case where the sides and ends join the floor; similarly where the ends join the sides, and where the top joins the sides and ends. This will be required only where the base of machine exceeds 500 lb. in weight; where the base of the machine does not exceed 500 lb. in weight, these framing or strengthening members will be of dimensions equal to the thickness of the lumber of the case proper.

When making up the frames for cases proper consideration must be given to the methods likely to be followed in hoisting the cases aboard cars and especially aboard the steamer. A matter that must not be overlooked, however, is the requirements of a rail shipment to tide-water, and the handling aboard the steamer, which will control the outside dimensions of any individual case.

The completed case must show close-fitting joints and be free from any projecting parts. All cases must be lined with "Keep Dry" brand of paper. After fully closed in, the entire case is to be well strapped with heavy box iron or strap iron; this must be done in such a manner that no board may become shattered or loosened at the end through rough handling while in transit.

Machines are to be shipped fully assembled, so far as it is practical to do so; however, all parts must be in a locked position, so that no matter how much the case is caused to oscillate while in transit aboard the steamer, no parts can work loose or suffer injury by movements within the case. Such parts as cannot be assembled with the machine must either be bolted fast to the sides or floor of the case, or inclosed in a smaller case strongly made. All machine parts must be held in position by means of blocking or braces securely fastened, and by using excelsior as a filler, such box or boxes must be bolted fast to the case. Whenever possible, each case is to contain one complete machine, including all regular equipment and with such other parts or supplies as is called for by the order or contract. Whenever possible, the machine must be bolted to the floor of the case, using machine bolts with extra nuts and plate washers underneath the floor.

Paint Finished Surfaces With Oil

All bright and finished surfaces are to be well painted with linseed oil and white lead paint, or anti-rust compound, or some other good protective compound which will be resistant to the corroding effects of salt air and salt water. Care should be exercised to use slushing oils which are free from acid.

It is the intention of these specifications to secure perfect delivery of machine tools and parts at final destination in Europe and so assembled that a minimum amount of time will be required to place the same in position and operation. Transportation conditions may be abnormal both as regards exposure to outdoor weather conditions and hauling during transportation; cases may not only have to protect contents within, but may have to support other cases piled many feet deep on top; the cases are likely to be placed in any position, such as on end, or upside down. All these conditions at their worst must be considered and guarded against in boxing machines.

Business Conditions in England

By Our English Correspondent

London, Nov. 21, 1919.

The decision of the British government to discontinue the unemployment donations to civilian men and women may, if persisted in, have a large influence on the industrial life of the country. While the donations will be continued for a while to ex-service men and women at the rate of 20s. a week for the former and 15s. a week for the latter (after a year at the higher rate), the dole to unemployed civilians is to be stopped immediately.

The latest figures show that at the middle of November the ex-service class to the number of 344,000 received out-of-work donations with 101,000 civilian men and about 34,000 civilian women. Included are some 40,000 men who were out of employment as the result of the molders' strike, the actual number of strikers being 95,000. An unemployment insurance scheme is expected from the government, but at the time of writing, at any rate, no bill has been introduced. Of course, certain trades, including the engineering trades, are already insured on a contributory system; in fact, the number of persons in occupations at present thus insured has been put at about 3½ to 3¾ million, out of a total approaching 14 million of insurable persons.

Great Britain has a scheme by which firms voluntarily undertake to employ men disabled in the war to the extent of 5 per cent. of their total force, the names of these firms being placed eventually on a roll of honor. The scheme is largely due to H. Rothband and the parliamentary committee concerned bears his name. At a recent meeting of the Ministry of Labor it was stated, according to an official communication, that some 7000 firms had completed plans, giving employment to nearly 70,000 disabled men, though vacancies were still being sought for 40,000 more. The government departments will absorb more than the 5 per cent. and up to the present about 170 public bodies have joined in the scheme. A proposal has been made that government contracts should be limited to the firms whose names appear on the roll. To bring this into force, however, a resolution of the House of Commons will be necessary, but it was intimated that the suggestion is being kept in mind.

The Ministry of Munitions and the Board of Admiralty have lately revoked orders under which establishments were declared to be controlled by them under certain sections of the Munitions of War Act of 1915, and the Amendment

Act of 1916. Firms thus decontrolled have been advised, not officially of course, to consider the effect of control on their working, and in particular to look into any loss of goodwill through loss of pre-war trade, allowances for extensions of various kinds, remuneration of directors and managers, outstanding claims, and liquidation of government contracts. In fact, a committee of controlled establishments exists to deal with such matters, and this committee will continue in being until the middle of 1920.

In the engineering world the throttling effect of the iron founders' strike becomes more and more apparent and throughout the country many firms are working short time and some are closing down, owing to want of castings. There is a faint hope that, before this matter can be published, the strike may be settled.

At the recent arbitration the engineering work people, who put in for a 15s. rise, were granted 5s. a week. The claim was at the same rate as that which the iron founders put forward, and there is just the possibility of the employing side making an offer of 5s. a week, and of the workmen accepting this offer; on the other hand, some indications suggest that nothing less than the granting of the original demand will be satisfactory. The strike, in fact, has spread. Originally confined to England, it is now being made operative over Scotland as well and men in English railway shops who belong to the railway men's union—not the iron founders'—have also been called out. Even when a satisfactory settlement has been reached it will be at least four or five weeks before engineering itself can resume at ordinary speed.

Workmen as a Body Not Producing

It cannot be said that workmen as a body are producing as much as previous to the war, though there are some exceptions; the writer heard of a ball-bearing factory which actually had increased the hourly output. Inquiries have suggested that in engineering, shipbuilding, coal mining and building, this lowering of activity is most pronounced. To it also is due some at least of the congestion and generally retarded services on the railways. The blame for low production is not always put on the work people. Misgivings are being expressed regarding organization and general direction and control in the shops.

For some time machine-tool firms have had no difficulty in filling their order books, their trouble of course having been to produce. Most firms, owing to lack of raw material and skilled labor, are quite unable to increase their output, and practically all in England are on short time, if not closed down, owing to the molders' strike. Toolmaking firms looking after the requirements of shipyard and marine-engine establishments are in a particularly happy position; they simply do not want anything likely to increase present inquiries—more work offers than can be coped with. The high prices obtainable for ships mean that the shipyards, etc., do not trouble greatly about the prices of any new tools they may be buying.

The effect of increasing costs of material and rising wages in industry was brought sharply to the notice of Londoners by the cessation from the London streets of the omnibuses of the National Steam Car Co., which is shutting down. The directors attended a select committee of the House of Commons and showed that paraffin (the fuel employed) had risen from 3¾d. a gallon in 1914 to 1s. 4d. now. Similarly, in less than a year increases of wages, awarded after inquiry as to cost of living, amounted to about £40,000 a year, based, it is stated, on a mileage of about 5,000,000, and a recent award of 4s. a week to certain employees meant a further £6,250 per annum. Allowing for depreciation at ¾d. a mile, the average daily loss from the beginning of November of this year was £356. The company is relatively small, operating about 133 buses, and, including the works at Chelmsford, the total number of workers and staff concerned in the stoppage is about 1100.

Olympia Motor Show

The Motor Show at Olympia, London, W., was attended during the 8 days by some 280,000 people. The show has never been a good place for the study of engineering details and this year the visitor simply went round with the crowd. A score of new firms made their appearance, but the chief sensation was caused by the sudden increase in price of two of the more-or-less mass-production organizations, the price increase being of the order of 20 per cent. All round, despite heavy taxation and high costs of all kinds, the rule is to spend. Probably at no motor-car show held in Great Britain have so many orders been offered as at the last.

The armament firms of Great Britain have necessarily revised their programs in an extremely radical manner, and this is particularly evident of Armstrong, Whitworth & Co., Ltd. At Scotswood, near Newcastle, the firm had shops which during the war produced 14½ millions of shells of all sizes, up to projectiles weighing more than a ton. These shops have now been entirely rearranged, reëquipped and reorganized for the production of locomotives, and the completion of the first main-line locomotive was the occasion of a banquet and a demonstration of the engine on Nov. 12, just a year after the armistice was signed. For the purpose of the gathering the engine was driven a short distance by Sir V. L. Raven, chief mechanical engineer of the Northeastern Railway for which the locomotive had been built. These new locomotive works are described as the largest in the British Empire; in fact, it has been claimed that before long they will be the largest self-contained locomotive works in the world. At Manchester, too, evidence of the changy times has been provided by the same firm. The sections of their works which were formerly producing mainly 8-in. howitzers and 18-pdr. guns are now devoted to machine-tool production, while a large shell shop has been given up to small-tool production—mainly milling cutters and reamers, twist drills, screwing apparatus, gages of all kinds, and special tools. Taking twist drills only, the range produced is from 0.05 in. up to 3 in., with corresponding metric sizes, and the weekly capacity of the plant is say 10,000 drills of average size. Generally, carbon-steel drills are not made above ½ in. in diameter nor high-speed steel drills below. The drills have a uniform taper in diameter of 0.0005 in. per inch length of flute, and the limits for diameters have been given as follows: up to ½ in. +0 −0.0008 in., above ½ in. and up to 1 in. +0 −0.0012 in., above 1 in. up to 2 in. +0 −0.002 in., and for sizes beyond, +0 −0.003 in. The output of the crucible steel department, which is almost adjoining, is about 2000 tons of high-speed steel per annum.

The Sunderland gear planing machines as produced by J. Parkinson & Son, Shipley, are already well known to American readers of this journal. The range of machines available has lately been increased. Up to the present they have been in sizes which at the upper limit will produce spur gears of 8 ft. 6 in. in diameter by 10½-in. face by 1¼ diametral pitch or 2½-in. circular pitch. A steel well, for example, with 80 teeth of 2½-in. circular pitch and 6-in. face has been cut in 18 hours. Now, to meet the requirements of the automobile industry and generally of the lighter branches of mechanical engineering, a machine is being manufactured to produce gears of practically any diameter up to 12 in. by 4-in. face and 5 diametral pitch or 5 module or ⅝-in. circular pitch. This machine has a double cutter box. With four wheels mounted in pairs, spur gears of cast iron, 58 teeth, 2-in. face, 5 d.p. have been cut in one hour; that is, an average of 15 min. for each wheel. Similarly, spiral gears of phosphor-bronze with two wheels mounted at once, one cutter used, the wheels being of 6⅝ in. in diameter, 28 teeth, ¾-in. face, 12 d.p. normal pitch and 60 deg. spiral, have been cut at the rate of 40 min. for each wheel. Spurs of special gear steel with 30 teeth, 7 diametral pitch, 1 in. face, cut twice round for good finish, four blanks being mounted at a time and two cutters used, take 6 min. for each wheel.

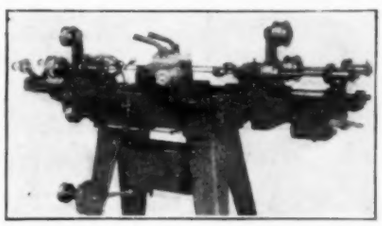
Government Passes Anti-Dumping Bill

The government has passed its anti-dumping bill, and it proves to be in certain respects more drastic than had been anticipated. While British manufacturers were to be protected from the competition of goods produced abroad and sold in the United Kingdom below the actual cost of production, these being the terms of the election manifesto by the heads of the prevailing coalition, the attempt is now sought to prevent foreign-produced goods being dealt with in Great Britain at selling prices below those prevailing in the country of origin.

Condensed-Clipping Index of Equipment

Patented Aug. 20 1918

Drilling Machines, Crankshaft Oil Holes
The Langelier Manufacturing Co., Providence, R. I.
"American Machinist," Sept. 25, 1919.

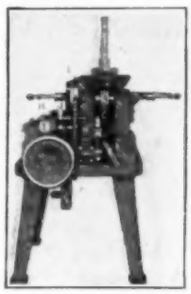


For drilling simultaneously ¼-in. oil holes in crankshafts. Drilling speed, 1800 r.p.m.; drilling lubricant supplied by rotary pump; lubricant filtered after using; Jacobs chucks hold drills; capacity of machine, 12 crankshafts per hour.

Drilling Machines, Piston Oil-Holes
The Langelier Manufacturing Co., Providence, R. I.
"American Machinist," Sept. 25, 1919.

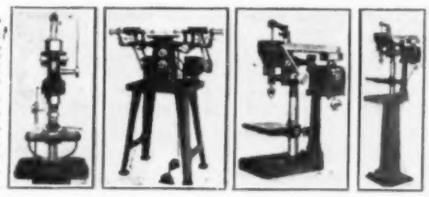
Drills simultaneously all oil holes in trunk piston. Has six two-spindle driving units each with a ½-hp. motor. Drills spindles inclined at an angle of 30 deg. to the horizontal. Machine has pump, tank and strainer, and a capacity of three pistons per minute.

Drilling Machines, Commutator Brush Connection
The Langelier Manufacturing Co., Providence, R. I.
"American Machinist," Sept. 25, 1919.



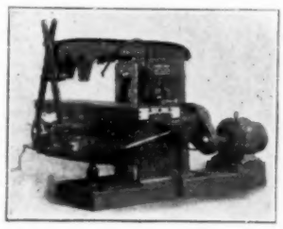
Two-spindle automatic drilling machine for drilling holes in the flexible connection through copper commutator brush. Work is fed through vertical magazine. Drill spindles driven by two 1-in. belts at 3200 r.p.m.; drive shaft driven at 600 r.p.m. by 3-in. belt.

Drilling Machines
Langelier Manufacturing Co., Providence, R. I.
"American Machinist," Sept. 25, 1919.



At the left—Multiple-spindle, sensitive drill for drilling phonograph gear; vertical table adjustment; screw chuck, and forced lubrication. In the center—a two-spindle horizontal machine for drilling typewriter parts; has a motor drive and both foot and hand feed. The two at the right—standard bench drills equipped with vertical motor drives; furnished with or without pedestal.

Milling Machine
Cincinnati Milling Machine Co., Cincinnati, Ohio
"American Machinist," Sept. 25, 1919.

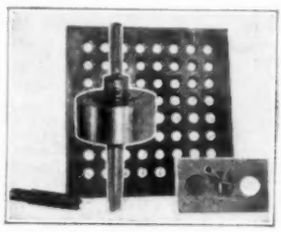


Size No. 4 plain; table, 68 x 19 in. with ¾-in. T-slots; power quick traverse; drive pulley, 16 in.; belt, 5 in.; horsepower of motor, 15; taper hole in spindle, No. 14 B. & S.; hole through spindle, 1¼ in.; floor space, 105 x 130 in.; net weight belt drive, 8900 lb.; belted motor drive, without motor, 9200 lb.; geared motor drive, without motor, 9600 lb.

Milling Machines
Cincinnati Milling Machine Co., Cincinnati, Ohio
"American Machinist," Sept. 25, 1919.

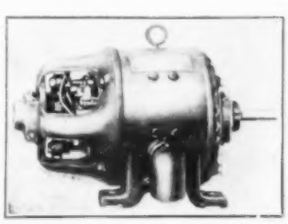
Size No. 4 universal; table 68 x 19 in. with ¾-in. T-slots; power quick traverse; drive pulley, 16 in.; belt, 5 in.; horsepower of motor, 15; taper hole in spindle, No. 14 B. & S.; hole through spindle, 1¼ in.; floor space, 105 x 130 in.; net weight belt drive, 9600 lb.; belted motor drive, without motor, 9900 lb.; geared motor drive, without motor, 10,300 lb.

Drilling Device, Square- or Hexagon-Hole
The Watts Bros. Tool Works, Turtle Creek, Penn.
"American Machinist," Sept. 25, 1919.



The equipment consists of floating type chuck, a special drill and guide plate, and is intended for use in ordinary drilling machine or lathe and recommended for work that cannot be broached. The tool is an end cutter and works similar to an end mill. The guide plate is clamped to the work and acts as a jig, the floating chuck permitting necessary lateral motion of the tool when cutting. The device is limited to depths of two and a half to three times the diameter of the hole. It is furnished in four sizes with capacities ranging from ¼- to 1½-in. holes.

Direct-Current Motors
The Allis-Chalmers Manufacturing Co., Milwaukee, Wis.
"American Machinist," Sept. 25, 1919



A line of commutating-pole direct-current motors designated as the Allis-Chalmers type E; the ratings and speeds of the constant speed motors are identical to those of 60-cycle induction motors. The adjustable-speed motors have a speed range of two to one, three to one, or four to one; motors are from ½ to 50 hp. and furnished as open type, semi-inclosed or totally inclosed.

Clip, paste on 3 x 5-in. cards and file as desired

Coal Production Reaches 10,413,000 Tons for Week

The weekly report on coal production compiled by the Geological Survey shows that the output for the week ended Dec. 20 reached 86.4 per cent of the average in the month before the strike was called. The total coal mined amounted to 10,431,000 tons as compared with a weekly average in October of 12,089,000 tons, which was an unusually high average.

Personals

B. M. BLACKWELL, recently head of the steel foundry of the Hart-Parr Co., Charles City, Iowa, has been appointed head of the steel foundry and pattern shop of the McDougall-Duluth Co., Duluth, Minn.

L. R. MEISENHALTER, of Philadelphia, has accepted the position of special representative of the Houston, Stanwood & Gamble Co., Cincinnati, Ohio. Mr. Meisenhalter has disposed of his interests in the L. R. Meisenhalter Machinery Co.

A. W. FITZPATRICK, for several years in charge of the service department of the Hart-Parr Co., Charles City, Iowa, has been appointed manager of its new tractor educational department. Mr. Fitzpatrick will be assisted by George Brochmeyer.

DAVID L. JULIAN, formerly connected with the E. J. Manville Machine Co., Waterbury, Conn., but for the past year and a half with the Columbus Bolt Works, Columbus, Ohio, is returning to the first-named company to accept a position as assistant superintendent.

Trade Catalogs

Thor Pneumatic Tools. Independent Tool Co., 600 West Jackson Blvd., Chicago, Ill. An illustrated circular of its pneumatic tools; specifications also included.

Pressure Volume and Indicator and Pitot Tubes. Bacharach Industrial Instrument Co., 422 First Ave., Pittsburgh, Pa. Pamphlet P summarizes the company's experience in the field of pitot tubes and orifices; pamphlet F describes a new pressure volume indicator suitable for either permanent installations or testing purposes.

Precision Heatmeter. The Brown Instrument Co., Philadelphia, Pa. This bulletin describes a new instrument for adjusting a millivoltmeter for any charge in resistance of the circuit of thermocouple leads and instrument.

Gisholt Machines. Gisholt Machine Co., Madison, Wis. A single folder briefly describing and illustrating the company's various machines.

Production and Inspection Tools. Taft-Peirce Manufacturing Co., Woonsocket, R. I. Bulletin No. 110, pp. 23, 10¼ x 8 in. This is devoted to Taft-Peirce production and inspection tools. Thread, plug and special cutters are described in another bulletin which may be had upon request.

Optical Pyrometer. The Leeds and Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Catalog No. 86-B, pp. 28, 10¼ x 7¾ in. A complete description is given of the construction, practical applications and physical theory of the optical pyrometer.

Condensite. Condensite Company of America, Bloomfield, N. J. This bulletin describes condensite, its properties, how it is molded, designed and also how to specify it.

Colonel A. L. Lamar has been designated by the Director of Sales to take direct charge of the execution of the contract with the French government for 25,000 machine tools. It was Colonel Lamar who engineered the sale to the Belgians of $5,000,000 worth of the War Department's surplus machinery.

Export Opportunities

The Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D. C., has inquiries for the agencies of machinery and machine tools. Any information desired regarding these opportunities can be secured from the above address by referring to the number following each item.

A former machinery manufacturer in Hungary desires to secure an agency for the sale in Hungary and Balkan States of machine manufactures. Ref. No. 31,342.

An American firm in Poland, which is planning to erect a machine shop, desires to secure an agency, purchasing goods outright, for the sale of machine tools, agricultural machinery, machinists' tools, and electrical equipment. Quotations should be given f.o.b. New York. Payment, cash. Reference. Catalogs and price lists are requested. Ref. No. 31,346.

An American concern which is soon to install machine shops in Russia desires to secure an agency for the sale in southern Russia of machine tools and overhead equipment for machine shops. Ref. No. 31,331.

The purchase is desired by a manufacturer in Belgium, whose factory was looted during the war, of lathes, shears, forging presses for bolts and nuts, bolt-cleaning machines, and screw-cutting lathes for belts and nuts. Reference. Catalogs and price lists are requested. Ref. No. 31,341.

An engineer in Italy desires to secure the agency for the sale of agricultural and industrial machinery, metals, etc. Correspondence should be in Italian or French. References. Ref. No. 31,330.

An engineer in Belgium desires to secure the exclusive agency for the sale of machine tools, material for electrical tramways, and for steel construction. Quotations should be given c.i.f. Antwerp. Terms, credit of 90 days. Correspondence may be in English. Reference. Ref. No. 31,547.

A company in Denmark desires to secure an agency for the sale of pig iron metals, especially steel, tool steel, machine tools, mining machinery and leather. Quotations should be given c.i.f. Swedish port. Correspondence may be in English. Ref. No. 31,385.

Representative is desired by a business man in France for the sale of machinery. Correspondence should be in French. Ref. No. 31,493.

War Contracts Liquidated by the War Department

War contracts liquidated by the War Department up to Dec. 6 totaled 18,233 formal contracts valued at $1,224,555,000 and 4,723 informal agreements valued at $924,919,999. It has cost $257,494,000 to liquidate these contracts.

There are 4,775 contracts remaining to be liquidated. Of these the value of 3,377 is known and amounts to $1,720,029,000.

Business Items

H. W. Johns-Manville Co. has announced the removal of its Des Moines office to 213 Ninth St.

The National Clutch Co., Inc., Irvington-on-Hudson, N. Y., has changed its name to the National Ignition Co., Inc.; no other changes have been made in its personnel.

The Hyatt Roller Bearing Co., New York City, has announced the opening of a western branch office which will be located at 309 Marshall Building, Cleveland, Ohio.

Catalogs Wanted

The Bridgeport Drafting and Engineering Co., 400 Warner Building, Bridgeport, Conn., has installed a catalog filing system, and would like to hear from concerns handling tool, shop equipment, structural steel and sheet-metal work.

Forthcoming Meetings

Boston Branch, National Metal Trades Association. Monthly meeting on first Wednesday of each month, alternating with the Employers' Association of eastern Massachusetts. George D. Berry, secretary, room 50-51, 166 Devonshire St., Boston, Mass.

Engineers' Club of Philadelphia. Regular meeting the third Tuesday of the month. Lewis H. Kenney is the chairman of committee on papers.

Electric Hoist Manufacturers' Association. Monthly meeting at the offices of the Yale & Towne Manufacturing Co., 9 East 40th St., New York City. Secretary W. C. Briggs, Shepard Electric Crane and Hoist Co.

Engineers Society of Western Pennsylvania. Monthly meeting, third Tuesday; section meeting, first Tuesday. Elmer K. Hiles, secretary, Oliver Building, Pittsburgh, Penn.

The motor-truck sections of the 20th Annual Automobile Shows of 1920 will hold an exhibition in the 8th Coast Artillery Armory, New York, Jan. 3 to 10, 1920, and in the International Amphitheatre, Chicago, Ill., Jan. 24 to 31, 1920.

Philadelphia Foundrymen's Association. Meeting first Wednesday of each month. Manufacturers' Club, Philadelphia, Penn., Howard Evans, secretary, Pier 45, North Philadelphia, Penn.

Rochester Society of Technical Draftsmen. Monthly meeting last Thursday. O. L. Angevine, Jr., secretary, 547 Arnett Boulevard, Rochester, N. Y.

The Society of Automotive Engineers will hold its annual meeting in New York on Jan. 6 to 8, inclusive. For further information of program, address the meeting committee, 239 West 39th St.

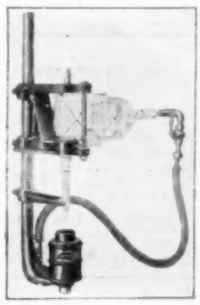
Condensed-Clipping Index of Equipment

Patented Aug. 20, 1918

Drilling and Countersinking Press, Portable

The Liberty Tool Co., Munsey Building, Baltimore, Md.

"American Machinist," Sept. 25, 1919

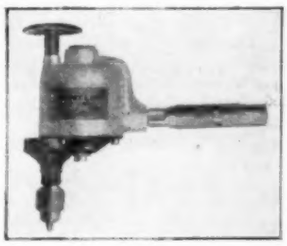


A portable drilling and countersinking press for air-drill work. The device will fit any make or shape of pneumatic drill, and is equipped with a 2¾-in. air cylinder at its base, which is used for a pneumatic feed. The device has a sliding head so that any work may be taken from ½ to 14 in. in thickness, drilling holes from ⅛ to 1 ⅞ in. in diameter, and countersinking up to 2 in.

Drill, Portable Air

The Duntley-Dayton Co., 1416 Michigan Ave., Chicago.

"American Machinist," Sept. 25, 1919



This is a multiple-cylinder air drill of the rotating-cylinder type and has three cylinders. The valve motion is governed by cams on the stationary crankshaft. All working parts run in oil; the motors are interchangeable. The tool is built in two sizes, No. 00 with a capacity of ¼-in. drills and No. 0 for ⅜-in. drills.

Truck Platforms, Elevating

The Lyon Manufacturing Co., Aurora, Ill.

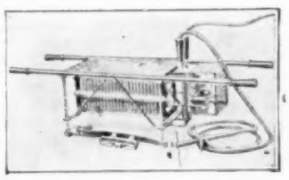
"American Machinist," Sept. 25, 1919

The elevating-truck platforms are designed to withstand heavy strains. The skid-legs consist of two welded feet that are in turn welded to a steel channel. The feet have round corners and ample bearing surface for the purpose of saving floors, and the channels are punched to a standard pattern so that extra tops of wood or steel can be carried in stock for replacement. The platforms can be made in any practicable width.

Arc-Welding Machine, Portable

Ohio Brass Co., Mansfield, Ohio

"American Machinist," Sept. 25, 1919

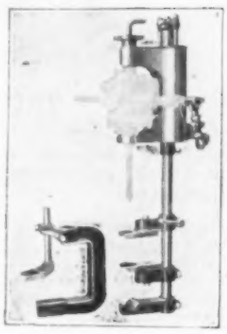


Designed primarily for welding rail bonds and intended particularly for use in mines, where space is at a premium. It has been found useful as a shop tool, owing to the fact that it can be easily carried by two men. The machine is simple and durable, cast grids furnishing the resistance; a circuit-breaker and remote control switch are provided for the convenience and safety of the operator. The remote control switch is located on the holder and is available for instant use when starting or stopping the current.

Drilling Machine, Portable

Liberty Tool Co., Munsey Bldg., Baltimore, Md.

"American Machinist," Sept. 25, 1919

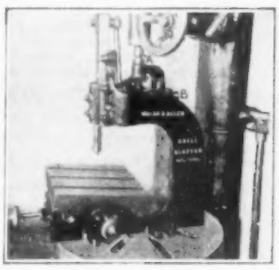


The device is equipped with a sliding head and sliding table, and has a pneumatic feed of 8 in., will take work up to ⅞ in. for drilling, and 2 in. for countersinking. It is designed to fit any make or shape of pneumatic drill. The air in the pneumatic feed cylinders is released by a three-way cock conveniently located to the handle of the pneumatic drill.

Slotting Attachment

Walsh & Allen, Wilbur Ave., Brooklyn, N. Y.

"American Machinist," Sept. 25, 1919



Arranged for mounting on the table of a drilling machine. Power is derived from the drilling-machine spindle through an ordinary drill socket. The attachment can be used on any suitable machine having a horizontal spindle. The maximum stroke is 4½ in.; table is 11 x 12 in. and can be fed ⅞ in. by hand in either direction; can be tilted 15 deg. The cutter bar is 1 in. in diameter and ordinary square toolbits are used for cutters. The attachment weighs 175 pounds.

Pipe-Cutting Machine

The Fox Machine Co., 1804 West Ganson St., Jackson, Mich.

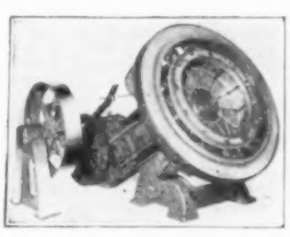
"American Machinist," Sept. 25, 1919

Will cut lengths up to 20 in. and any size from ¼ to 6 in. Specifications: Floor space, 29 x 38 in.; height of table, 28 in.; size of tight and loose pulleys, 14 x 4 in.; pulley speed, 300 r.p.m.; cutter shaft speed, 100 r.p.m.; cutter disk diameter, 6 in.; net weight, 1500 lb.; domestic shipping weight, 1800 lb.; export shipping weight, 2300 lb.; cubic contents, 52 cu.ft.; for motor drives, allow 150 lb. additional.

Upsetting Machine, Tire-Rim

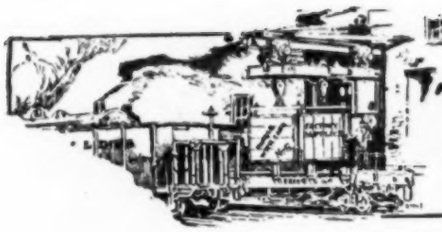
Charles Grotnes Machine Works, 128 N. Jefferson St., Chicago.

"American Machinist," Sept. 25, 1919



A friction clutch is provided, but the machine in operation runs continuously, making eight strokes per minute, a capacity of eight rims per minute. Specifications: Floor space, 91 x 72 in.; height, 67 in.; pulley, 36 x 6 in.; maximum stroke, each jaw, 1⅝ in.; strokes per minute, 8; net weight, 9500 lb.

Clip, paste on 3 x 5-in. cards and file as desired



THE WEEKLY PRICE GUIDE

IRON AND STEEL

PIG IRON—Quotations compiled by The Matthew Addy Co., as per Department of Commerce Committee Schedule.

	Current	One Month Ago
CINCINNATI		
No. 2 Southern	$36.60	$36.60
Northern Basic	34.00	34.00
Southern Ohio No. 2	36.55	36.55
NEW YORK—TIDEWATER DELIVERY		
2X Virginia (Silicon 2.25 to 2.75)	39.40	39.40
Southern No. 2 (Silicon 2.25 to 2.75)	41.40	41.40
BIRMINGHAM		
No. 2 Foundry	33.00	33.00
PHILADELPHIA		
Eastern Pennsylvania No. 2	38.10*	38.10
Virginia No. 2	39.10*	39.10
Basic	34.60†	34.60
Grey Forge	34.60*	34.60
CHICAGO		
No. 2 Foundry local	36.25	36.25
No. 2 Foundry, Southern	38.00	38.00
PITTSBURGH, INCLUDING FREIGHT CHARGE FROM VALLEY		
No. 2 Foundry		
Basic	34.40	34.40
Bessemer	35.40	35.40

* F. o. b. furnace. † Delivered.

STEEL SHAPES—The following base prices per 100 lb. are for structural shapes 3 in. by ¼ in. and larger, and plates ¼ in. and heavier, from jobbers' warehouses at the cities named:

	New York			Cleveland		Chicago	
	Current	One Month Ago	One Year Ago	Current	One Year Ago	Current	One Year Ago
Structural shapes	$3.47	$3.47	$4.27	$3.62	$4.17	$3.47	$4.27
Soft steel bars	3.52	3.52	4.17	3.52	4.17	3.52	4.17
Soft steel bar shapes	3.52	3.52	4.17	5.50	4.17	3.52	4.17
Soft steel bands	4.22	4.22	4.77				
Plates, ¼ to 1 in. thick	3.67	3.67	4.52	3.82	4.42	3.67	4.25

Note—For less than carload lots, add 4¼c. per 100 lb.

BAR IRON—Prices per 100 lb. at the places named are as follows:

	Current	One Year Ago
Mill, N. Y.	$3.10	$3.50
Warehouse, New York	3.52	4.75
Warehouse, Cleveland	3.42	4.67
Warehouse, Chicago	3.52	4.10

SHEETS—Quotations are in cents per pound in various cities from warehouse; also the base quotations from mill:

	Mill Carloads, Pittsburgh	New York		Cleveland	Chicago
		Current	One Year Ago		
No. 28 black	$4.35–4.85	$7.00–8.00	$6.52	$5.77	$6.00
No. 26 black	4.25–4.75	6.90–7.90	6.42	5.67	5.90
Nos. 22-24 black	4.20–4.71	6.85–7.85	6.37	5.62	5.85
Nos. 18-20 black	4.15–4.65	6.80–7.80	6.32	5.57	5.80
No. 16 blue annealed	3.75–4.20	6.02	5.72	5.17	5.02
No. 14 blue annealed	3.65–4.10	5.92	5.62	5.07	4.92
No. 10 blue annealed	3.55–4.00	5.50–6.00	5.52	4.97	4.82
No. 28 galvanized	5.70–6.20	7.50–9.00	7.77	7.12	7.25
No. 26 galvanized	5.40–5.90	7.20	7.47	6.82	6.95
No. 24 galvanized	5.25–5.75	7.05	7.32	6.57	6.52

COLD FINISHED STEEL—Warehouse prices are as follows:

	New York	Chicago	Cleveland
Round shafting or screw stock, per 100 lb. base	$5.00	$4.90	$5.00
Flats, square and hexagons, per 100 lb. base	5.50	5.40	

DRILL ROD—Discounts from list price are as follows at the places named:

	Per Cent.
New York	55
Cleveland	50
Chicago	50

SWEDISH (NORWAY) IRON—The average price per 100 lb., in ton lots is:

	Current	One Year Ago
New York	$21.00–26.00	$19.00
Cleveland	20.00	20.00
Chicago	16.50	19.00

In coils an advance of 50c. usually is charged.
Domestic iron (Swedish analysis) is selling at 15c. per lb.

WELDING MATERIAL (SWEDISH)—Prices are as follows in cents per pound f.o.b. New York, in 100 lb. lots and over:

Welding Wire		Cast-Iron Welding Rods	
1/16, 5/64, 3/32, 7/64, 1/8, 9/64, 5/32, No. 8, 11/64 and No. 10, 3/16, No. 12, 7/32, No. 14 and 1/4, No. 18, No. 20	21.00 to 30.00	1/16 by 12 in. long	14.00
		3/32 by 19 in. long	12.00
		1/8 by 19 in. long	10.00
		1/4 by 21 in. long	10.00
		Special Welding Wire, Coated	
		1/16	33.00
		3/32	30.00
		1/8	38.00

Domestic 20c. for 1/16, 15c. for 1/8 to 1/4

MISCELLANEOUS STEEL—The following quotations in cents per pound are from warehouse at the places named:

	New York Current	Cleveland Current	Chicago Current
Openhearth spring steel (heavy)	6.00	8.00	8.00
Spring steel (light)	8.00	10.00	10.00
Coppered bessemer rods	8.00	8.00	6.75
Hoop steel	4.47	4.75	4.07
Cold-rolled strip steel	8.40	8.25	7.50
Floor plates	5.67	6.00	5.92

Note—For less than carload lots, add 4¼c. per 100 lb.

PIPE—The following discounts are for carload lots f.o.b. Pittsburgh; basing card of National Tube Co. for steel pipe, Cardry A. M. Byer's Co. for iron, both dated Mar. 21, 1919.

BUTT WELD

Inches	Steel Black	Steel Galvanized	Inches	Iron Black	Iron Galvanized
1/8, 1/4 and 3/8	50%	24%	1/8 to 1 1/4	30%	23 1/2%
1/2	54 1/2%	40%			
3/4 to 3	57 1/2%	44%			

LAP WELD

2	50 1/2%	35%	2	32 1/2%	18 1/2%
2 1/2 to 6	53 1/2%	41%	2 1/2 to 6	34 1/2%	21 1/2%

BUTT WELD, EXTRA STRONG PLAIN ENDS

1/8, 1/4 and 3/8	46 1/2%	29%	1/8 to 1/4	39 1/2%	24 1/2%
1/2	51 1/2%	39%			
3/4 to 1 1/4	55 1/2%	43%			

LAP WELD, EXTRA STRONG PLAIN ENDS

2	48 1/2%	37%	2	33 1/2%	20 1/2%
2 1/2 to 4	51 1/2%	49%	2 1/2 to 4		23 1/2%
4 1/2 to 6	50 1/2%	39%	4 1/2 to 6	34 1/2%	22 1/2%

Stock discounts in cities named are as follows:

	Black	Galv.	Black	Galv.	Black	Chicago Galv.
1/8 to 3 in. steel butt welded	47%	31%	43 1/2%	34 1/2%	57 1/2%	44%
2 1/2 to 6 in. steel lap welded	42%	27%	45 1/2%	39 1/2%	53 1/2%	41%

Malleable fittings. Class B and C, banded, from New York stock sell at plus 12 1/2% less 5%. Cast iron, standard sizes, 10–5% off.

METALS

MISCELLANEOUS METALS—Present and past New York quotations in cents per pound, in carload lots:

	Current	One Month Ago	One Year Ago
Copper, electrolytic	19.00	20.00	26.00
Tin in 5-ton lots	57.50	53.87 1/2	72.00
Lead	7.50	6.80	7.05
Spelter	8.625	8.30	8.60
ST. LOUIS			
Lead	6.35	6.55	6.75
Spelter	8.10	7.95	8.25

* Lead scarce in New York market.

At the places named, the following prices in cents per pound prevail, for 1 ton or more:

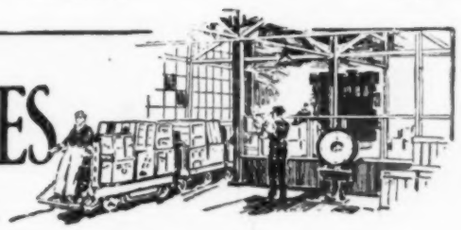
	New York			Cleveland		Chicago	
	Current	Month Ago	Year Ago	Current	Year Ago	Current	Year Ago
Copper sheets, base	28.50	33.50	38.00	29.50–31.00	38.00	35.00	38.00
Copper wire (carload lots)	28.00	29.00	35.00	28.50	35.00	26.00	38.00
Brass sheets	25.50	32.00	39.75	28.00	30.50	26.00	38.00
Brass pipe	30.50	36.00	46.00	34.00	42.50	34.00	44.00
Solder (half and half) (case lots)	35.00	45.00	55.00	35.50	47.50	33.00	65.00

Copper sheets quoted above hot rolled 16 oz., cold rolled 14 oz. and heavier, add 2c.; polished takes 5c. per sq.ft. extra for 20-in. widths and under; over 20 in., 7½c.

BRASS RODS—The following quotations are for large lots, mill. 100 lb. and over, warehouse; net extra:

	Current	One Year Ago
Mill	22.75	36.00
New York	24.00	38.40
Cleveland	28.00	38.50
Chicago	25.00	29.50

SHOP MATERIALS AND SUPPLIES



ZINC SHEETS—The following prices in cents per pound prevail:

Carload lots f.o.b. mill 11.50

	—In Casks— Current	One Year Ago	— Broken Lots — Current	One Year Ago
Cleveland	11.50	18.75	12.00	21.50
New York	13.00	17.00	13.50	20.25
Chicago	15.00	22.00	15.00	21.50

ANTIMONY—Chinese and Japanese brands in cents per pound, in ton lots for spot delivery, duty paid:

	Current	One Year Ago
New York	9.75-10	9.50-10.50
Chicago	10.50	10.00
Cleveland	11.75	11.625

OLD METALS—The following are the dealers' purchasing prices in cents per pound:

	— New York — Current	One Year Ago	—Cleveland— Current	One Year Ago	Chicago
Copper, heavy and crucible	17.50	18.00	18.50	21.00	17.25
Copper, heavy and wire	15.50	17.00	19.00	21.00	16.75
Copper, light and bottoms	13.50	15.00	15.50	19.00	15.75
Lead, heavy	6.25	5.00	6.25	6.00	6.50
Lead, tea	5.00	4.00	4.25	5.00	5.50
Brass, heavy	9.00	9.50	13.25	14.50	17.00
Brass, light	8.00	8.50	9.75	11.50	10.00
No. 1 yellow brass turnings	9.50	10.00	11.50	13.50	10.50
Zinc	5.00	5.00	5.00	5.50	6.00

ALUMINUM—The following prices are from warehouse at places named:

	New York	Cleveland	Chicago
No. 1 aluminum, 98 to 99% pure, in ingots for remelting (1-15 ton lots), per lb	33.00c.	34.00c.@35.00c.	33½c.

COPPER BARS—From warehouse sell as follows in cents per pound, for ton lots and over:

	Current	One Year Ago
New York (round)	34.00	40.00
Chicago	28.00	40.00
Cleveland	31.00	33.50

BABBITT METAL—Warehouse price per pound:

	—New York— Current	One Year Ago	—Cleveland— Current	One Year Ago	— Chicago — Current	One Year Ago
Best grade	90.00	95.00	68.50	93.00	60.00	96.00
Commercial	55.00	50.00	17.25	23.00	13.00	25.00

SHOP SUPPLIES

NUTS—From warehouse at the places named, on fair-sized orders, the following amount is deducted from list:

	— New York — Current	One Year Ago	— Cleveland — Current	One Year Ago	— Chicago — Current	One Year Ago
Hot pressed square	List	.80	$1.00	$1.25	$1.45	.98
Hot pressed hexagon	List	.80	1.00	1.05	1.45	.78
Cold punched hexagon	List	2.50	1.00	.75	1.05	1.00
Cold punched square	List	2.50	1.00	.75	1.05	1.00

Semi-finished nuts sell at the following discounts from list price:

	Current	One Year Ago
New York	70-5%	50-10%
Chicago	50%	50%
Cleveland	60-10%	50-10%

MACHINE BOLTS—Warehouse discounts in the following cities:

	New York	Cleveland	Chicago
½ by 4 in. and smaller	30%	50%	35-5%
Larger and longer up to 1¼ in. by 30 in.	20%	40%	25-5%

WASHERS—From warehouses at the places named the following amount is deducted from list price:

For wrought-iron washers:

New York..... $1.50 Cleveland..... $3.75 Chicago..... $3.00

For cast-iron washers the base price per 100 lb. is as follows:

New York..... $7.00 Cleveland..... $3.75 Chicago..... $4.25

CARRIAGE BOLTS—From warehouses at the places named the following discounts from list are in effect:

	New York	Cleveland	Chicago
½ by 6 in. and smaller	25%	40-5%	30%
Larger and longer up to 1 in. by 30 in.	15%	37½%	20%

COPPER RIVETS AND BURS sell at the following rate from warehouse.:

	Rivets Current	One Year Ago	Burs Current	One Year Ago
Cleveland	30%	List plus 10%	30%	List plus 10%
Chicago	20%	List price	20%	List plus 20%
New York	30%	15% from list	10%	List plus 5%

RIVETS—The following quotations are allowed for fair-sized orders from warehouse:

	New York	Cleveland	Chicago
Steel ½ and smaller	40%	55% off	50%
Tinned	40%	55% off	50%

Boiler, ½, ⅝, 1 in. diameter by 2 to 5 in. sell as follows per 100 lb.:

New York..$5.00 Cleveland...$4.00 Chicago....$4.87 Pittsburgh...$4.72

Structural, same sizes:

New York...$5.10 Cleveland...$4.10 Chicago....$4.97 Pittsburgh....$4.82

MISCELLANEOUS

SEAMLESS DRAWN TUBING—The base price in cents per pound from warehouse in 100-lb. lots is as follows:

	New York	Cleveland	Chicago
Copper	32.00	36.00	35.90
Brass	30.50	34.00	34.00

For immediate stock shipment 3c. is usually added. The prices, of course, vary with the quantity purchased. For lots of less than 100 lb., but not less than 75 lb., the advance is 2c.; for lots of less than 75 lb., but not less than 50 lb., advance is 5c. over base (100-lb. lots); less than 50 lb., but not less than 25 lb., 10c. should be added to base price; quantities from 10-25 lb., extra is 25c.; less than 10 lb., add 35c.

Double above extras will be charged for angles, channels and sheet metal mouldings if ordered in above quantities. Above extras also apply to brass rod other than standard stock sizes—stock sizes being considered as ⅛-2 in. inclusive in rounds, and ⅛-1½ in., inclusive, in square and hexagon—all varying by thirty seconds up to 1 in. by sixteenths over 1 in. On shipments aggregating less than 100 lb., there is usually a boxing charge of $1.50.

COTTON WASTE—The following prices are in cents per pound:

	NEW YORK Current	One Year Ago	Cleveland	Chicago
White	13.00	11.00-13.00	14.00	11.00 to 14.00
Colored mixed	9.00 to 12.00	8.50-12.00	11.00	9.50 to 12.00

WIPING CLOTHS—Jobbers' price per 1000 is as follows:

	13½x13½	13½x20½
Cleveland	52.00	58.00
Chicago	41.00	43.50

SAL SODA sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$2.25	$2.25	$1.75
Philadelphia	2.00	2.00	1.75
Cleveland	2.50	2.50	2.625
Chicago	2.00	2.00	2.00

ROLL SULPHUR in 360-lb. bbl. sells as follows per 100 lb.:

	Current	One Month Ago	One Year Ago
New York	$3.40	$3.40	$3.65
Cleveland	4.625	3.875	4.25
Chicago	F4.12½	4.125	4.50

COKE—The following are prices per net ton at ovens, Connellsville:

	Dec. 9	Dec. 2	Nov. 9
Prompt furnace	$6.00	$6.50	$6.00
Prompt foundry	7.00	7.00	7.00

FIRE CLAY—The following prices prevail:

		Current
Ottawa, bulk in carloads	Per Ton	$8.00
Cleveland	375-lb. bag	2.50

LINSEED OIL—These prices are per gallon:

	— New York — Current	One Year Ago	— Chicago — Current	One Year Ago
Raw in barrels (5 bbl. lots)	$1.90	$1.59	$1.77	$1.90
5-gal. cans	2.10	1.84	1.97	2.00

WHITE AND RED LEAD—Base price per pound:

	— Red — Current Dry	In Oil	One Year Ago Dry	In Oil	— White — Current Dry and In Oil	One Year Ago Dry and In Oil
100 lb. keg	14.00	15.50	14.00	15.50	14.00	14.00
25 and 50-lb. kegs	14.25	15.75	14.25	15.75	14.25	14.25
12½-lb. keg	14.50	16.00	14.50	16.00	14.50	14.50
5-lb. cans	16.00	17.50	.....	.....	16.00	16.00
1-lb. cans	17.00	18.50	.....	.....	17.00	17.00

500 lb. lots less 10% discount. 2000 lb. lots less 10-2½% discount.

NEW AND ENLARGED SHOPS

Consult the Buying Section when in need of machinery or supplies

Metal Working

NEW ENGLAND STATES

Conn., Hartford—Colonial Auto Co., 1,279 Main St., has awarded the contract for the construction of a 1 story, 60x150 ft. garage, sales and service station, on Washington St. Estmiated cost, $30,000.

Conn., Hartford—The Hartford Fairmont Co., 41 Arch St., manufacturer of glass machinery, has awarded the contract for the construction of a 1 and 2 story, 93 x 194 ft. addition to its factory.

Conn., Naugatuck—The Naugatuck Chemical Co., c/o Lockwood-Green Co., Arch., 101 Park Ave., New York City, will soon award the contract for the construction of a factory.

Conn., Thomaston—The Seth Thomas Clock Co., care of Lockwood Greene & Co., Arch. and Engr., 101 Park Ave., New York City, will soon award the contract for the construction of a 2 story, 60 x 120 ft. and a 4 story, 60 x 120 ft. factory buildings.

Conn., Torrington—The Torrington Co., 59 Field St., manufacturers of Eagle marine engine, has awarded the contract for the construction of a 2 story, 50 x 340 ft. factory, on North Elm St.

Conn., Waterbury—The Scoville Manufacturing Co., 99 Mill St., manufacturer of brass goods, has awarded the contract for the construction of a 1 story, 12 x 22 ft. and 30 x 100 ft. factory, on Silver St. Estimated cost, $28,000.

Mass., Quincy—C. W. Hodgkinson, Alden St., is having plans prepared by W. H. Taylor & Son, Arch., 50 Bromfield St., Boston, for the construction of a 1 story, 85 x 100 ft. garage, on Washington St. Estimated cost, $25,000.

Mass., Williamsett (Holyoke P. O.)—C. P. Church Manufacturing Co., manufacturer of plumbers' goods, has awarded the contract for the construction of a 1 story, 40 x 170 ft. factory, 50 x 60 ft. storage building and 37 x 51 ft. office building. Estimated cost, $40,000.

Mass., Worcester—The Franklin Motor Car Co., 3 King St., will soon award the contract for the construction of a 1 story, 160 x 186 ft. service station. Estimated cost, $70,000. J. Rice, 306 Main St., Arch.

Mass., Worcester—The C. H. Tenny Co., 201 Devonshire St., Boston, plans to build an 8 story plant for the Worcester Cold Storage Co., on Hygeia St. Estimated cost, $300,000

MIDDLE ATLANTIC STATES

Md., Baltimore—The Burt Machine Co., 402 East Oliver St., has awarded the contract for the construction of a 2 story, 30 x 40 ft. factory at 410 East Oliver St., for the manufacture of labeling machines. Estimated cost, $12,500. O. E. Adams, 2038 Park Ave., Arch.

Md., Curtis Bay (Baltimore P. O.)—The Curtis Bay Copper and Iron Works, Beech St., will build a 1 story, 75 x 230 ft. addition to its factory. Estimated cost, $100,000. J. W. Lehr, Mgr.

Md., Westport—McNamara Bros., Kloman St., are having plans prepared by H. F. Doeleman, Engr., 507 North Charles St., Baltimore, for the construction of a 1 story, 80 x 200 ft. tank and boiler factory. Estimated cost, $50,000.

N. Y., Farmingdale—The Raymond Engineering Corporation, 309 Lafayette St., New York City, manufacurer of typewriters, phonographs, motor and power tire pumps, will build two 1 story, 60 x 120 ft. factories, here. Estimated cost, $175,000.

N. Y., New York (Borough of Brooklyn)—J. Crawford, 753 Flatbush Ave., will build a 1 story, 100 x 190 ft. garage on Church Ave. and Johnson Pl. Estimated cost, $30,000.

N. Y., New York (Borough of Brooklyn)—M. Friedland, c/o P. Caplan, Arch., 16 Court St., plans to build a 1 story, 100 x 150 ft. garage on 36th St. Estimated cost, $35,000.

N. Y., New York (Borough of Brooklyn)—F. Kelsey, c/o Parfitt Bros., 26 Court St., will build a 1 story, 100 x 196 ft. service station on West 8th St., Coney Island.

N. Y., New York (Borough of Brooklyn)—J. Sclicowitz, 503 Myrtle Ave., will build a 1 story, 100 x 100 ft. garage on Fulton St. and Hopkinson Ave. Estimated cost, $30,000. A. Brook, 215 Montague St., Arch.

N. Y., New York (Borough of Manhattan)—The Mulberry Garage Corporation, 299 Broadway, will build a 1 story, 93 x 99 ft. garage at 52 West 46th St. Estimated cost, $40,000.

N. Y., New York (Borough of Manhattan)—The New York Sheet Metal Works, 413 East 91st St., will build a 1 story factory at 509 East 80th St. Estimated cost, $25,000.

N. Y., New York (Borough of Manhattan)—L. Schurmacher, 1,128 1st Ave., is having plans prepared by L. A. Sheinart, Arch., 192 Bowery, for the construction of a 2 story, 75 x 130 ft. garage at 1124 1st Ave. Estimated cost, $25,000.

N. Y., New York (Borough of Queens)—The Transport Service Co., 125 Harris Ave., Long Island City, has awarded the contract for the construction of a 5 story, 75 x 100 ft. garage and service station, on Harris and Sherman Ave. Estimated cost, $200,000.

N. Y., Port Chester—T. R. Mallory Co., Inc., Fox Island Rd., has awarded the contract for the construction of a 2 story, 40 x 112 ft. factory, for the manufacure of wire. Estimated cost, $25,000. Noted Sept. 11.

N. Y., Syracuse—C. G. Hanna Co., South Clinton St., plans to build a 4 story, 132 x 133 ft. garage on East Genesee St. Estimated cost, $165,000.

N. Y., Syracuse—Tompkins Brothers Co., 538 South Clinton St., manufacturer of knitting machinery, has awarded the conract for the construction of a 1 story, 40 x 120 ft. and 72 x 300 ft. factory, on Talman St. Estimated cost, $80,000.

N. J., Trenton—The American Steel and Wire Co., Hamilton Ave., plans to build a 1 story, 60 x 100 ft. wire mill. Estimated cost, $20,000.

Penn., Johnstown—The Twin Valley Motor Co. plans to construct a 3 story, 66 x 160 ft. garage and sales room at 206 Main St. Estimated cost, $50,000.

MIDDLE WEST

Ill., Chicago—The Brennan Packing Co., 4013 Normal Ave., has awarded the contract for the construction of a 2 story, 75 x 140 ft. packing plant. Estimated cost, $100,000.

Ill., Chicago—Jewel Electric Instrument Co., 1640 42nd St., will soon award the contract for the construction of a 3 story, 50 x 100 ft. factory. Estimated cost, $50,000. Berlin, Swern & Randall, 19 South La Salle St., Arch.

Ill., Chicago—W. J. Quan, 1310 West 79th St., will soon award the contract for the construction of a 1 story, 75 x 120 ft. garage at 1304 West 79th St. Estimated cost, $25,000. A. G. Lund, 453 West 63rd St., Arch.

Ill., Harvey—The Buda Co., manufacturer of railroad supplies, has awarded the contract for the construction of a 2 story, 140 x 160 ft. foundry, on Vincennes Ave. and 151st St. Estimated cost, $75,000.

Ind., Portland—Board of Education is having plans prepared by W. Scholer, Arch., State Life Bldg., for the construction of a 2 story, 62 x 83 ft. manual training and domestic science building. Estimated cost, $75,000.

Mich., Detroit—The Detroit Motor Casting Co., Beaufait St., has awarded the contract for the construction of a 1 story, 60 x 155 ft. foundry. Estimated cost, $35,000.

Mich., Detroit—The Hup Motor Car Co., Milwaukee and Mt. Elliott Ave., has awarded the conract for the construction of a 4 story, 73 x 396 ft. factory, on Milwaukee and Moran Ave.

Mich., Detroit—M. A. Young, 754 Woodward Ave., has awarded the contract for the construction of a 3 story, 60 x 186 ft. sales and service station. Estimated cost, $125,000.

Mich., Lansing—The Detroit Beef Co., 1214 Washington St., has awarded the contract for the construction of a 2 story, 19 x 42 ft. garage and 30 x 92 ft. cold storage plant, on Washington St. along the Grand Trunk R.R. Estimated cost, $50,000.

Ohio, Akron—The Goodyear Tire & Rubber Co., East Market St., has awarded the contract for constructing a 3 story, 120 x 340 ft. machine shop. Estimated cost, $25,000.

Ohio, Cincinnati—E. H. Bardis Range Co., Culerain and Alfred St., plans to build a 2 story, 85 x 102 ft. pattern shop. Kruckemeyer & Strong, St. Paul Bldg., Arch.

Ohio, Cincinnati—The King Machinery Co., Winton Pl., has awarded the contract for the construction of an addition to its factory. Estimated cost, $50,000.

Ohio, Cleveland—The L. M. Axle Co., 247 Colonial Arcade, plans to build a 2 story, 90 x 210 ft. factory on East 49th St. Estimated cost, $100,000. H. E. Shimmen, 2031 Euclid Ave., Arch.

Ohio, Cleveland—The Bender Auto Body Co., c/o H. Bender, & M. Eiben of Northern Blower Co., Barberton Ave., will soon award the conract for the construction of a 1 story 100 x 250 ft. factory at West 65th St. and Denison Ave. Estimated cost, $150,000.

Ohio, Cleveland—The Enamel Products Co., 341 Eddy Rd., manufacturer of enamel products, will soon award the contract for the construction of a 1 story, 100 x 200 ft. factory, on Eddy Rd. and Taft Ave. Estimated cost, $60,000. Withington Roberts & Wright Co., Swetland Bldg., Arch.

Ohio., Cleveland—The Guide Motor Lamp Co., 11400 Madison Ave., has awarded the contract for the construction of a 1 story, 120 x 500 ft. factory and boiler house, on West 110th St. Estimated cost, $200,000.

Ohio, Cleveland—The Ohio Blower Co., 9301 Detroit Ave., has awarded the contract for the construction of a 5 story, 65 x 300 ft. factory. Estimated cost, $300,000.

Ohio, Dayton—The Dayton Pneumatic Tool Co., Chapel Rd., plans to build a 2 story, 100 x 100 ft. addition to its factory. Estimated cost, $75,000.

Ohio, Dayton—The Domestic Engineering Co., Taylor St., plans to build a 6 story, 80 x 300 ft. factory, on Webster St., for the manufacture of electrical specialties. Estimated cost, $200,000. Schenk & Williams, Mutual Home Bldg., Arch.

Ohio, Dayton—The Garford Dayton Sales Co., Main St., has awarded the contract for the construction of a 1 story auto sales building and garage, on North Main St. Estimated cost, $60,000.

Ohio, Dayton—The Miami Brass Foundry Co., McDonough and Bacon St., plans to build a 3 story, 75 x 120 ft. factory and foundry, on McDonough St. Estimated cost, $100,000.

Ohio, Dayton—The Stanley Manufacturing Co., Cannon St., manufacturer of metal and leather letters, has awarded the contract for the construction of a 3 story, 40 x 80 ft. factory. Estimated cost, $25,000.

Ohio, Springfield—The Robbin-Myers Co., Lagonda Ave., will soon award the contract for the construction of a 4 story, 80 x 300 ft. factory, for the manufacture of motors. Estimated cost, $100,000. W. S. Russ, 313 North Pennsylvania St., Indianapolis, Ind., Arch.

Wis., Manitowoc—The Aluminum Goods Manufacturing Co., 15th and Franklin St., has awarded the contract for the construction of a 1 story, 300 x 340 ft. rolling mill. Estimated cost, $300,000.

Wis., Milwaukee—The Cadillac Motor Co. 1343 Cass St., Detroit, Mich., has awarded the contract for the construction of a 2 story, 102 x 255 ft. service station on North Ave. Estimated cost, $200,000.

Wis., Milwaukee—Cemco Manufacturing Co., 742 South Pierce St., manufacturer of auto parts and accessories, has awarded the contract for the construction of a 2 story, 50 x 150 ft. factory. Estimated cost, $50,000.

Wis., Milwaukee—The General Manufacturing Corporation, 1520 Buffum St., will soon award the contract for the construction of a 2 story, 60 x 100 ft. factory, for the manufacture of phonographs. Estimated cost, $56,000. M. Tullgren & Sons, 425 East Water St., Arch.

Wis., Milwaukee—The Ogden Motor Car Co., 692 National Ave., plans to build a 1 story, 100 x 200 ft. addition to its factory. Estimated cost, $60,000.

Wis., Milwaukee—The W. S. Seaman Co., 480 Virginia St., has awarded the contract for the construction of a 5 story, 100 x 420 ft. L-shaped factory, for the manufacture of automobile bodies. Estimated cost, $400,000.

Wis., Racine—The Harvey Spring and Forging Co., 17th and Murray Sts., manufacturer of automobile springs, has awarded the contract for the construction of a 2 story, 100 x 200 ft. factory. Estimated cost, $60,000.

Wis., Shawno—The Shawno Canning Co., c/o G. Grant, Mgr., plans to build a 3 story, 58 x 112 ft. canning factory on Main St. Estimated cost, $48,000.

Wis., Watertown—The Monarch Tractor Co., c/o W. Roy, Supt., plans to build a 1 story, 80 x 100 ft. factory on Main St. Estimated cost, $35,000.

WEST OF THE MISSISSIPPI

Kan., Topeka—R. Knowles has awarded the contract for the construction of a 1 story, 50 x 130 ft. garage and sales room. Estimated cost, $75,000.

Minn., Minneapolis—The Berger Manufacturing Co., 300 10th Ave. S., manufacturer of steel ceilings, plans to build a 1 story, 80 x 112 ft. addition to its plant, on Ulysses St. and Broadway, N. E. Estimated cost, $60,000.

Minn., Minneapolis—Harris Realty Co., New England Bldg., is having revised plans prepared by C. L. Kinport, Arch., Andrus Bldg., for 2 story, 100 x 120 ft. garage, on Lincoln and Aldrich Ave. S. Estimated cost, $52,000.

Mo., St. Louis—The Bayer Steam Soot Blower Co., 282 La Salle St., has awarded the contract for the construction of a 3 story, 120 x 140 ft. soot blower factory, on Thurman and Park Ave. Estimated cost, $125,000.

Okla., Oklahoma City — The Deignan Motor Co. will soon award the contract for the construction of a 2 story, 100 x 190 ft. motor sales and service building. Estimated cost, $100,000. F. C. Gunn, 606 West 39th St., Arch.

Tex., Houston—P. S. Griffith, 909 Carter Bldg., will build a 3 story, 41 x 100 ft. garage and office building on Lousiana and Polk St. Estimated cost, $30,000.

WESTERN STATES

Cal., Stockton—The Kroyer Tractor Manufacturing Co. is having plans prepared by F. V. Mayo, Arch., 512 Farmers Bank Bldg., for constructing a group of factory buildings. Estimated cost, $1,000,000.

Ore., Portland—The Specialty Foundry Co., 440 Belmont St., will build a 2 story, 100 x 100 ft. foundry and machine shop, on East 10th and Belmont St. Estimated cost, $25,000.

Wash., Pullman—T. C. Martin will soon award the contract for the construction of a 2 story, 120 x 120 ft. garage on Grand and Oleson St. Estimated cost, $40,000.

CANADA

Ont., Toronto—The Automobile Service Co., 139 Pears Ave., is having plans prepared by Banigan & Thompson, Arch., 7 King St. E., Toronto, for the construction of a 6 story garage, on Richmond St. Estimated cost, $600,000.

Ont., Toronto—Baldwins Limited, Ashbridges Bay, has awarded the contract for the construction of a 1 story, 70 x 800 ft. factory, for the manufacture of steel plate. Estimated cost, $200,000.

Ont., Woodstock—The Brunswick Canadian Products Co. plans to build a factory for the manufacture of phonographs. Estimated cost, $200,000.

Que., Montreal—H. Birks & Co., Ltd., Phillips Sq., will soon award the contract for the construction of a 10 story, 50 x 100 ft. factory on St. Monique and Cathcart St., for the manufacture of jewelry, etc. Estimated cost, $350,000.

Que., Montreal—O. Deserres, 204 St. Denis St., will soon award the contract for the construction of a 4 story, 50 x 50 ft. factory on Sanguinet St. for the manufacture of automobiles and hardware. Estimated cost, $35,000.

Que., Montreal—The McClary Manufacturing Co., 20 Wellington St., manufacturer of stoves, will soon award the contract for the construction of a 4 story, 50 x 75 ft. factory. Estimated cost, $100,000.

General Manufacturing

NEW ENGLAND STATES

Conn., Danbury—The Danbury Felt Mills have awarded the contract for the construction of a 2 story, 60 x 160 ft. factory, with a 35 x 40 ft. ell, also a 1 story, 18 x 36 ft. boiler house. Estimated cost, $80,000.

Conn., New Haven—A. C. Gilbert, c/o Lockwood, Green & Co., Arch. and Engr., 101 Park Ave., New York City, will soon award the contract for the construction of a 3 story, 80 x 100 ft. factory, for the manufacture of toys. Estimated cost, $80,000.

Conn., West Haven (New Haven P. O.)—The Kelley Tire and Rubber Co., 962 Chapel St., New Haven, has awarded the contract for the construction of a 3 story, 75 x 260 ft. factory, a 2 story, 40 x 40 ft. office building, a 1 story, 50 x 80 ft. powerhouse, and a 2 story, 25 x 25 ft. spreader building, on Elm St., for the manufacture of tires and tubes. Estimated cost, $400,000.

Mass., Haverhill—Whittier Bldg., Inc., First National Bldg., has awarded the contract for the construction of an 8 story, 65 x 160 ft. factory, on Washington St., for the manufacture of shoes. Estimated cost, $300,000.

Mass., Holyoke—The Farr Alpaca Co., Jackson St., has awarded the contract for the construction of a 3 story, 147 x 200 ft. and a 4 story, 75 x 147 ft. factory, for the manufacture of cloth. Estimated cost, $350,000.

Mass., New Bedford—The W. Whitman Co., 78 Chauncey St., Boston, has awarded the contract for the construction of a cotton yarn mill plant. Estimated cost, $1,500,000.

Mass., Roxbury (Boston P. O.)—The Miller Candy Co., 116 North St., Boston, has awarded the contract for alterations to its factory, on Heath and Parker St. Estimated cost, $100,000.

Mass., Watertown—The Hood Rubber Co., Nichols Ave., has awarded the contract for the construction of a 1 and 2 story, 60 x 220 ft. addition to its plant. Estimated cost, $80,000.

R. I., Providence—The Revere Rubber Co., 355 Valley St., has awarded the contract for the construction of a 2 story 50 x 90 ft. factory. Estimated cost, $100,000.

R. I., Woonsocket—The Woonsocket Wagon Manufacturing Co., 15 Worrall St., will build a 2 story, 75 x 200 ft. addition to its factory. Estimated cost, $100,000.

MIDDLE ATLANTIC STATES

Md., Baltimore — The American Sugar Refining Co., 117 Wall St., is having plans prepared by the company's engineers for the construction of a sugar refining plant, on Locust Pt. harbor front. Estimated cost, $8,000,000.

Md., Baltimore—R. C. Kolb, 10th and Reed St., Philadelphia, Penn., plans to build a 1 and 2 story, 60 x 200 ft. bakery on Pennsylvania and North Ave., here. Estimated cost, $20,000. W. W. Slack & Co., 142 State St., Trenton, N. J., Arch.

Md., Curtis Bay (Baltimore P. O.)—The Standard Wholesale Phosphate Co., 1214 Continental Bldg., Baltimore, has awarded the contract for the construction of a 1 story, 60 x 216 x 320 ft. factory for the manufacture of acid phosphate, on Aspin St. Estimated cost, $72,000.

Md. Sparrows Point — The Bethlehem Steel Co. will soon award the contract for the construction of a 1 story, 50 x 262 ft. factory for the manufacture of boxes. Estimated cost, $70,000.

N. J., Asbury Park—The Rydon Tire and Rubber Co., c/o E. A. Arend, Arch., 105 West 40th St., New York City, will soon award the contract for the construction of a factory. Estimated cost, $100,000.

N. J., Harrison—The Driver-Harris Co., manufacturer of microne products, c/o Lockwood, Green & Co., Arch. and Engr., 101 Park Ave., New York City, will soon award the contract for the construction of a 3 story, 50 x 100 ft. shipping building and addition to its factory, also a 6 story, 80 x 200 ft. factory.

N. J., Hoboken—Owens & Traeger, 1101 Madison Ave., have awarded the contract for the construction of a 5 story, 80 x 200 ft. factory on 11th St., for the manufacture of paper boxes. C. Fall, 1400 Washington St., Arch.

N. J., Newark—The Morris Twine Co. will soon award the contract for the construction of a 1½ story, 121 x 250 ft. addition to its factory. W. Steele & Sons Co., 16th and Arch St., Phila., Arch.

N. Y., Long Island City—C. E. Shepard, 311 Hudson St., New York City, manufacturer of loose leaf covers, will soon award the contract for the construction of a 3 story factory, on Van Alst Ave., here. Estimated cost, $250,000. H. Balcom, 10 East 47th St., New York City, Arch.

N. Y., New York (Borough of Brooklyn)—The Hudson Bag Co., 77 Washington St., manufacturer of paper bags, will soon award the contract for the construction of a 2 story, 200 x 265 ft. factory and warehouse on Bogert, Scholes and Meserole St. Estimated cost, $30,000. L. Allmendinger, 20 Palmetto St., Arch.

N. Y., New York (Borough of Brooklyn)—Kirsch & Hersel, 214 Scholes St., will soon award the contract for the construction of a 1 and 2 story, 50 x 217 ft. factory, on Flushing Ave., for the manufacture of mineral water. Estimated cost, $30,000.

N. Y., New York (Borough of Manhattan)—B. Winer, c/o Zipkes, Wolff & Kudroff, Arch., 25 West 42nd St., has awarded the contract for the construction of a 6 story laundry, at 204-206 East 107th St. Estimated cost, $40,000.

N. Y., New York (Borough of Manhattan)—E. C. De Witt, 212 5th Ave., will soon award the contract for altering his chemical factory, at 244 East 52nd St. Estimated cost, $50,000. E. J. Lang, 477 5th Ave., Arch.

N. Y., New York (Borough of Queens)—The Perfect Window Regulator Co., 415 Greenpoint Ave., Brooklyn, has awarded the contract for the construction of a 1 story, 95 x 240 ft. factory, on Harris and Van Alst Ave., Long Island City.

N. Y., North Tonawanda—The Buffalo Sled Co., 107 Woodward Ave., has awarded the contract for the construction of a 2 story, 80 x 360 ft. and a 1½ story, 80 x 140 ft. factory.

N. Y., Port Jervis—S. J. Sonnenburg, 220 Straight St., has awarded the contract for the construction of a 1 story, 50 x 200 ft. mill, for the manufacture of silk. Estimated cost, $30,000.

Penn., Hazleton—The Hazleton Silk Throwing Co. plans to construct a 1 story, 35 x 60 ft. silk mill. Estimated cost, $50,000.

Penn., Philadelphia — The Federal Hosiery Mills, Janney and Cambria St., has awarded the contract for the construction of a 2 story, 70 x 150 ft. factory, for the manufacture of hosiery. Estimated cost, $100 000.

Penn., Philadelphia—The J. R. Kendrick Co., 25 Herman St., has awarded the contract for the construction of a 3 story, 60 x 125 ft. factory, for the manufacture of elastic hosiery, on Germantown and Pastorious St.

Penn., Philadelphia—The Standard Tin Foil Corporation, c/o Austin Co., Eng., Bulletin Bldg., has awarded the contract for the construction of a 1 story, 130 x 260 ft. factory on Cedar and Tioga St. Estimated cost, $85,000.

Penn., Scranton — The Klots Throwing Co., c/o Lockwood Greene & Co., Arch., 101 Park Ave., New York City., will soon award the conract for the construction of a 2 story, 116 x 200 ft. factory for the manufacture of silks.

SOUTHERN STATES

Ky., Bowling Green—The Atlantic Producing and Refining Co., recently organized with a capital of $1,500,000, has purchased and will develop oil properties, also build additions to plant for refining petroleum, manufacturing lubricating oil and wax. W. G. Williams, Pres.

N. C., Durham — The Durham Hosiery Mills will soon award the contract for the construction of a 4 story, 80 x 125 ft. mill. J. S. Sinine, Greenville, S. C., Arch.

N. C., Greenboro — The Pomona Mills, Inc., will soon award the contract for the construction of a 1 story, 60 x 110 ft. mill. J. E. Sirrine, Greenville, S. C., Arch.

N. C., Mabane—The Durham Hosiery Mills, Durham, plans to build a 2 story, 106 x 300 ft. hosiesy mill, here. J. E. Sirrine, Greenville, S. C., Engr.

N. C., Orangeburg—J. E. Sirrine, Engr., Greenville, S. C., will soon award the contract for the construction of a 1 story, 65 x 90 ft. cotton mill, for Santee Mill.

S. C., Bamberg — The Bamberg Cotton Mills will soon award the contract for the construction of a 2 story, 52 x 375 ft. cotton mill. J. E. Sirrine, Greenville, S. C., Arch.

MIDDLE WEST

Ill., Chicago — The Armour Fertilizer Works, Union Stock Yards, have awarded the contract for the construction of an acid plant. Estimated cost, $150,000.

Ill., Chicago—The Mutual Broom Co., 1505 South Halsted St., will soon award the contract for the construction of a 2 story, 100 x 125 ft. factory, on Ogden Ave. and Polk St. Estimated cost, $60,000.

Ill., Rockford—The Ziock Paper Box Co., South Wyman St., has awarded the contract for the construction of a 13 story, 70 x 104 ft. factory for the manufacture of paper boxes and hosiery, on South Main St. Estimated cost, $200,000.

Mich., Detroit—Feigenson Bros., 118 Benton St., has awarded the contract for the construction of a 3 story, 82 x 90 ft. bottling works, on Erskine and Beaubie St. Estimated cost, $30,000.

Mich., Grand Rapids — Sonneveld Bros., 815 Leonard St., N. W., plans to build a 2 story bakery and storehouse, on Leonard St., N. W., and Alpine St. Estimated cost, $40,000. P. Lindhout, 817 Lake Drive, Arch.

Ohio, Cincinnati—The Gibson Art Co., Elm St., has awarded the contract for the construction of a 6 story, 146 x 168 ft. factory and office building, on 4th and Plum St.

Ohio, Cincinnati—Stacey Bros., Gas Construction Co., 5535 Carthage Pike, plan to build a factory. Estimated cost, $200,000.

Ohio, Cleveland—A. A. Chilcote, 733 Prospect Ave., manufacturer of photo supplies, will soon award the contract for the construction of a 1 story, 100 x 140 ft. factory, on Superior Ave. Estimated cost, $30,000.

Ohio, Cleveland—The Cleveland Printing Ink Co., 1104 Prospect Ave., has awarded the contract for the construction of a 2 story, 40 x 99 ft. shop, at 1106 Hamilton Ave. Estimated cost, $50,000. F. O. Nitch, Mgr.

Ohio, Cleveland—The Lion Knitting Mills Co., 1051 Powers Ave., has awarded the contract for the construction of a 2 story, 83 x 95 ft. factory on West 25th St. and Meyer Ave. Estimated cost, $60,000. L. H. Enaten, Secy.

Ohio, Columbus—The Columbus Dental Co., 634 Wagner St., will soon award the contract for the construction of a 2 story, 38 x 100 ft. addition to its factory.

Ohio, Dayton—The Allsteel Ridewell Tire and Rubber Co., Dayton Saving and Trust Bldg., plans to build a 3 story, 100 x 200 ft. factory, for the manufacture of automobile tires. Estimated cost, $100,000.

Ohio, Elyria—The Winner Cord Tire and Rubber Co., 702 National City Bldg., Cleveland, has purchased a site here and plans to build a factory for the manufacture of cord tire. Estimated cost, $300,000.

Wis., Ft. Atkinson—The Creamery Package Manufacturing Co., Ft. Atkinson Bldg., has awarded the contract for the construction of a 2 story, 40 x 90 ft. enameling plant. Estimated cost, $25,000.

Wis., Manitowoc—Juul & Smith, Arch., Dempsey Bldg., will soon award the contract for the costruction of a 2 story, 75 x 175 ft. canning factory, for A. H. Franke, 1119 Columbus St. Estimated cost, $80,000.

Wis., Marinette—The American Toy Horse Co. plans to build two 1 or 2 story, 100 x 200 ft. factories, for the manufacture of toy horses. Estimated cost, $150,000. H. Greene, 425 East Water St., Milwaukee, Pres.

Wis., Milwaukee—The Walsh Harness Co., 330 First Wisconsin National Bank Bldg., has awarded the contract for the construction of a 1 story, 50 x 200 ft. factory, on Hubbard and Keefe St. Estimated cost, $60,000.

Wis., Racine—The Racine Confectioners' Machinery Co., 1630 Racine St., is having plans prepared by D. R. Davis, Arch., 526 Wisconsin St., for the construction of a 2 story, 50 x 165 ft. factory and a 1 story, 38 x 120 ft. machine shop. Estimated cost, $60,000.

Wis., Tomah—The Tomah Rubber Works, 176 16th St., Milwaukee, has awarded the contract for the construction of a 2 story, 100 x 100 ft. factory. Estimated cost,$45,000.

Wis., Waukesha—The Bethesda Mineral Spring Co., 301 Dunbar Ave., plans to build a 1 and 2 story, 40 x 60 ft. bottling plant. Estimated cost, $25,000. Van Ryn & De Gelleke, Caswell Blk., Milwaukee, Arch.

WEST OF THE MISSISSIPPI

Mo., St. Louis—The Southern Car Wheel Co., Railway Exchange Bldg., plans to build a 1 and 2 story 120 x 135 ft. factory, on Euclid Ave. Estimated cost, $400,000.

Okla., Sapulpa—C. R. Webb plans to build a flour mill here. Estimated cost, $50,000.

Tex., Dallas—The Monarch Petroleum Co., Western Indemnity Bldg., recently organized with a capital stock of $2,000,000, has purchased a 30 acre site and plans to build a 5000 bbl. refinery in West Dallas. Estimated cost, $500,000. J. R. Aiken, Pres.

WESTERN STATES

Calif., Emeryville (Oakland P. O.)—The American Rubber Co. will soon award the contract for the construction of a 2 story factory. Estimated cost, $100,000. W. J. Miller, 417 Market St., San Francisco, Arch.

Ore., Portland—The Crystal Ice and Storage Co., 432 East Salmon St., is having plans prepared by Camp & Du Puy, Arch., 426 East Alder St., for the construction of a 3 story, 110 x 115 ft. factory for the manufacture of ice cream, on East 7th and Main St. Estimated cost, $125,000.

Ore., Portland—The Eagle Mill Co. is having plans prepared by J. V. Bennes, Arch., Chamber of Commerce Bldg., for the construction of a 7 story mill for the manufacture of flour and cereals, and a 1 story, 100 x 130 ft. warehouse. Estimated cost, $200,000.

CANADA

B. C., Sapperton—The Canada Western Cordage Co. has awarded the contract for the contraction of a 2 story, 150 x 200 ft. factory and warehouse. Estimated cost, $76,000.

Ont., Port Credit—The St. Lawrence Starch Co., has awarded the contract for the construction of a 4 story, 60 x 150 ft. factory. Estimated cost, $90,000.

Machine Tools Wanted

The following concerns are in the market for machinery and machine tools.

N. Y., North Tonawanda—The Buffalo Sled Co., 107 Woodward Ave.—equipment for the manufacture of sleds.

Penn., Philadelphia—The Federal Hosiery Mills, Janney and Cambria St.—machinery for the manufacture of hosiery.

Fla., Tampa—The Tampa Dock Co., 17th and 1st Ave.—punch and shear with 36 to 40 in. throat for ¾ in. plates and a set of from 8 to 12 ft. bending rolls for ¾ in. plate (used).

S. C., Charlotte—A. Garsed Co.—lathes and milling machines.

Ind., Indianapolis—O. N. Moore Co., East Washington St.—3 Hendy 6 x 14 Q. C. G. taper lathes.
1 Cataract 7 x 18 Q. C. G. bench lathe.
One No. 3 Brown & Sharpe universal miller.
One No. 3 Brown & Sharpe vertical miller.
1 hand miller.
One No. 3 Brown & Sharpe universal grinder.
One No. 1 Brown & Sharpe universal grinder.
One No. 1 Brown & Sharpe surface magnetic chuck grinder.
One No. 2 Brown & Sharpe surface magnetic chuck grinder.
One No. 1 Norton tool and cutter grinder.
One No. 75 Heald internal magnetic chuck grinder.
One 16 to 24 in. Blanchard magnetic chuck vertical rotary surface grinder.
One emery stand, 1 to 10 in. wheels.
One No. 14 Cochrane-Bly shaper.
One 20 in. G. & E.-B. G. shaper.
One 16 in. G. & E.-B. G. shaper.
One 8 ft. x 28 x 28 in. Gray Cincinnati planer.
One ⅜ in. capacity drill.
One 20 in. capacity drill.
One 24 in. capacity drill.
One Rearwin filing machine.
Six 3½ in. Prentiss swivel base vices.
Six 4 in. Prentiss swivel base vices.
Hardening equipment for above.
One 10 h.p. 220 volt, 3 phase motor.
One 100 ft. 2⅞ shafting with flanged couplings.
Sixteen 18 in. hangers roller or ring oil bearings.
Belting and pulleys for above.
It will be noted that the make of machines is preferred, however, quotations will be acceptable on good standard substitutes.

Mich., Detroit—Feigenson Bros., 118 Benton St.—bottling machines, washers, etc.

Mich., Detroit—The Hup Motor Car Co., Milwaukee and Mt. Elliott Ave.—crane, traveler and conveyors.

Ohio, Cincinnati—The Marsh Murdock Coal Co., Stanton and Melish Ave.—conveyor.

Ohio, Cleveland—The Bender Auto Body Co., c/o H. Bender & M. Eiben of Northern Blower Co., Barberton Ave.—special stamping machinery.

Ohio, Cleveland—The Cleveland Printing Ink Co., 1104 Prospect Ave.—ink grinding and pressing machines.

Ohio, Cleveland—The Guide Motor Lamp Co., 11400 Madison Ave.—special stamping machines, presses and cutting machines for brass work.

Wis., Milwaukee—The Bethesda Mineral Spring Co., 301 Dunbar Ave.—bottling machinery.

Wis., Milwaukee—The Federal Textile Co., 1306 First Wisconsin National Bank Bldg.—knitting machinery.

Wis., Milwaukee—The Ludwig-Wolf Ice Cream Co., 608 Caswell Bldg.—refrigerating machinery.

Wis., Milwaukee—The Milwaukee Brush Manufacturing Co., 51 Erie St.—woodworking machinery.

Wis., Racine—The Harvey Spring and Forging Co., 17th and Murray St.—traveling crane.

Colo., Colorado—The Strang Garage Co., 26 North Nevada Ave.—No. 60 Heald cylindrical grinder (new).

Mo., St. Louis—The Counts-Soap Co., 5236 North Market St.—1 grease container, 1,500 gal. capacity, 3 sets acetylene welding outfits, 1 punch press, 23 thermometers and 6 or 7 electric trucks.

Mo., St. Louis—The Rown Electric Manufacturing Co., c/o W. Lesseig, Pur. Agt., 713 Star Bldg.,—eleven 10 x 26 in. lathes, four No. 4 plain millers, one small speed lathe, six bench drills, one geared head turret lathe, one or more 1 in. bolt cutter, one 12 in. shaper. Hangers, belts, pulleys, conveyors, etc.

Ont., Toronto—Baldwins Limited, Ashbridge Bay—crane and machinery for the manufacure of steel plate.

Ont., Toronto—The A. R. Williams Machinery Co., Ltd., 64 Front St., W.—No. 2 Fosdick horizontal boring mill or similar (new).